JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

The Coalite Mystery Exploded.

THE mystery of mysteries in connection with the production of solid smokeless fuel has at last been revealed, and the revelation is edifying. On another page of the "JOURNAL" to-day will be found an authentic copy of the as yet officially-unpublished specification of Patent No. 14,365, of 1906, granted to Mr. Thomas Parker for "Improvements in and "relating to fuel." This is understood to be the master-patent under which Coalite is produced; and the mystery with which the exploiters of that product have hitherto attempted to envelop its process of manufacture is exploded. We have always questioned the expediency of the system of inviting investors to supply the needful capital for the exploitation of an undisclosed invention; and the disclosure shows that, in the present instance at least, those who have responded to the invitation are likely to have cause to regret their blind faith in an invention which the Company promoter advised should be screened as long as might be from the fierce light of publicity.

The originality of much of the process described in Mr. Thomas Parker's specification should be properly credited to Murdoch and other pioneers in gas manufacture. Murdoch used vertical iron retorts, of which the cross sectional dimensions were not less than 6 inches; and it may be safely averred that, under the conditions prevailing with him, the temperature within his iron retorts was not infrequently about 800° Fahr. Yet more than a century later, Mr. Thomas Parker is found describing such a type of retort heated to that temperature as suitable for the carbonization of bituminous coal for the production of a practically smokeless fuel. Other forms of retort, Mr. Parker says, may be used, such as a horizontal Ω-shaped metal retort, 5 ft. wide and 7 ft. long, in which the charge of coal is disposed in a layer not exceeding 6 inches deep. With such a charge, the heating will generally last about six hours. Or closed cylinders about 10 or 12 inches in diameter may be used for readily fusible coals. In fact, anyone who works under Mr. Parker's patent may use Murdoch's century-old vertical iron retorts, or any other more or less inconveniently shaped, dimensioned, and disposed metal retort. But the temperature within the retort must be about 800° Fahr. during the process of distillation; small masses of coal only must be carbonized at a time; and carbonization must be stopped when *illuminating* gas ceases to be evolved. The originality of the process stands revealed! Moreover, the gases evolved are passed through a condenser, scrubber, and purifier, and otherwise dealt with substantially in the same manner as is usual in the ordinary method of the manufacture of coal gas. We are gratified to notice that Mr. Parker has not scorned to take advantage of some at least of the methods and processes of the gas industry.

The users of the modern forms of vertical retort, such as those established at Bournemouth, Cologne, and a host of other places, must be careful lest they inadvertently infringe Mr. Parker's claims. They have all been in the habit of admitting steam into their retorts towards the end of the carbonizing process; but they must now observe that this practice is adopted in the manufacture of Coalite. No doubt the proprietors of Mr. Parker's patent rights will be willing for a consideration to allow them to continue to admit steam towards the end of the carbonizing process. But before the Coalite people press their claims, perhaps they will ascertain whether the use of steam in carbonization anteceded Mr. Parker's "discovery."

The Coalite invention, however, is not confined to the actual carbonizing methods, for the fuel is quenched in a particular manner. It may be quenched either before or after being drawn from the retort, but preferably after. Had Mr. Parker sought novelty for novelty's sake, he would have preferred to quench in the retort itself. But he is content—nay, he prefers—to draw the fuel into a receptacle where it is no longer subjected to heat, and after its closure to quench it by admitting steam. He is even good enough to tell us why he quenches by the admission of steam—viz., so that the fuel may not re-ignite. Water in liquid form would not presumably answer; and it would not serve to stifle combustion by the mere closure of the receptacle. Steam savours more of novelty for quenching purposes; and then it is such an admirable cooling medium! We suppose highly superheated steam will be best, for the reason that steam is preferred to water; but Mr. Parker does not enlighten us on this point.

We may recommend readers of the "JOURNAL" to glance through Mr. Parker's specification, not on account of the innate merits of the invention which it discloses, but in order that they may appreciate how little or how much they have to fear from the Coalite works which are reported to be under construction at Barking and elsewhere. What Mr. Parker claims to have achieved is a hard fuel "capable of use with-"out any further treatment, and which in burning in an "open grate develops more heat than ordinary coal, lasts "longer in burning, and is moreover practically smokeless "in combustion." Gas engineers who have made coke all their working lives will wonder that he has had to conceive ill-shapen retorts, and to use steam for quenching, in order to produce such a fuel. But we live and learn.

Gas Acts—The Non-Penalty Tests.

ELSEWHERE this week, we sketch the main features of the Acts with which a few statutory Gas Companies and Local Authorities have fortified themselves in the past session. Generally speaking, there is not much feature about them commanding special consideration, because, excepting in one or two instances, they went through with merely minor changes. In these Acts, as in those of the newly incorporated Companies whose fresh powers were reviewed last week, the standard illuminating power of gas is consistently 14 candles; and the "Metropolitan" No. 2 burner, and the 10-candle pentane lamp are the ordained standard testing instruments. Of some interest are the superfluous non-penalty testing clauses in the Mitcham and Wimbledon Company's Act. They are of the same lineament as those applying to the Metropolitan Gas Companies; but beyond the academical interest attaching to the calorific power tests, there can be no real value in the results produced by the other tests. Their conception no doubt sprang from the desire to collect the material for some prospective action, rather than to add to scientific knowledge. Assuming this view of the purpose to be correct, there can be no possible use in extending the application of these clauses. The testing under these clauses of the gas of the London Companies alone assuredly furnishes a sufficient variety of condition to give a copious supply of information; and whatever the character of the information obtained by means open (in at least two cases) to the gravest suspicion and objection, Parliament would weigh the contentment of the consumers with the present supply against any such disclosures of the testing-station. On the Continent, illuminating power is completely scouted; and not until incandescent gas lighting is advancing with enormous strides in this country, and the flat-flame burner is being discarded daily as an abased instrument for obtaining illumination, does meddlesome authority, with a fine display of ignorance, desire the application of flat-flame testing for ostensibly information only, though it is conceded that the flat-flame burner employed should be of the best available pattern, and be so used as to obtain from the gas the greatest amount of light. Surely to trouble about flat-flame testing at this time of day is a setting-back of the hands of the clock with a vengeance.

The same cannot be said of testing by a burner fitted with an incandescent mantle, with the mantle and burner also of the best available pattern, and used so as to obtain from the gas the greatest amount of light; but this can be said, that a more useless and unreliable test for anything but passing

interest could not be devised. Who is to decide which, out of the host of excellent incandescent burners and mantles now on the market, are the best available patterns for any one particular gas? Again the clauses do not prescribe the form of incandescent burner—whether the use of the vertical or inverted type is optional; and there are those who are prepared to aver that the best incandescent burner (for ordinary use) which will "obtain from the gas the greatest amount of light" is the inverted. However the results of these incandescent burner tests can only claim interest as showing what duty the burner was rendering under the specific conditions prevailing at the time of the test; and nothing more. It must be admitted that the making of incandescent burners has been brought up to a high state of perfection, but not to the perfection requisite for testings on which the same measure of faith can be placed as in the case of tests made by means of burners constructed with the refinement necessary for standards. Also in making mantles, which go through so many processes, each affected by quality of material and the acts of several operatives, there cannot be that fine consistency in production that would enable one to say that any two mantles were so precisely alike that, used under concordant conditions, their results would be similar. Tested on the same burner, different mantles from the same box produce undulations in the curve representing results sufficient to show that the exactness does not exist that should obtain in official testings. To put the matter in a nutshell, there are no means known by which the conditions—personal and instrumental—contributing to result can be equated, so as to put a higher value upon the issues of testings at one and at different testing-stations. We have this all set out emphatically in the didactic thesis presented by M. Emile Sainte-Claire Deville to the International Photometric Commission in July last. From his extensive and many-featured experiments, he extracts the opinions that the illuminating duty of a particular gas burnt under the same mantle may vary within wide limits, and that, in the existing state of the mantle industry, it would be impossible to establish any specification for the direct determination of the illuminating power of gas in incandescent burners. Then, regarding these non-penalty illuminating power tests by flat-flame and incandescent burners we ask, *Cui bono?*

Concerning other subjects suggested by the new Acts. Although there has been abundant warning, there are Gas Companies who, on a proposition for a reduction of standard illuminating power, still try to slip through without conceding anything from their standard price. But the authorities will not brook this. The Basingstoke and Falmouth Companies both under their former Acts had 15-candle gas, with a standard price of 4s. 2d. Their illuminating power has now been reduced to 14 candles; and between entrance and exit of their measures, the standard prices have had to recede to 4s. The Mitcham and Wimbledon Company entered Parliament with a proposal for a standard price of 3s. 6d.; by agreement, they have dropped to 3s. 2d. The Pontypridd District Council have had 1s. taken from their maximum price of 5s.; and their standard illuminating quality of gas now conforms with the modern parliamentary notion of 14 candles. The 10 and 15 per cent. discount clause in the Basingstoke measure was dropped during its passage through Parliament; and in most of the Acts there is to be found affixed to section 13 of the Gas-Works Clauses Act, 1847, the satisfying words referred to in the editorial columns last week. This session, through the Joint Act for the removal of sulphur restrictions and that of the Maidstone Company, the legislative absurdity regarding sulphur compounds has been almost blotted out. In the Worthing Company's Act, a new gas-works site is authorized; but the greater part of the boundary of the site is to be planted with non-deciduous trees to appease the æsthetic tastes of certain folk at Goring. The Company are, by agreement with the Worthing Corporation, to complete the transfer of their manufacturing operations within ten years; and the Corporation have also limited, but have not been too close-fisted over the matter, the amount of undivided profit that the Company may henceforth carry forward. This final consideration of the gas legislation of the past session may be fitly closed with a word of gratification that the gas-purchase section of the Kingston-upon-Hull Corporation Bill has no place in the Act; and for the exercise of justice that enables us to say this, the House of Lords are to be thanked. It was one of those predatory attacks on private interests that cannot boast a shred of justification.

A North of England Address and Paper.

WITHOUT detracting from the interest permeating the Presidential Address of Mr. H. Wilkinson, of Harrogate, to the members of the North of England Association last Saturday, we could almost wish that he had begun the address at the point where he left off. "As one who commenced "his career under different conditions from those prevailing "now, may I," the President concluded, "offer to the "younger members of the profession my congratulations "upon the opportunities that are now presented to them "and which, with strenuous effort, may open out to them "positions of great responsibility, honour, and appropriate "remuneration. The future of the gas industry is with you "young men." Underlying those words is a wealth of suggestion for an address that should inspire young men, and should do something to awaken the greater interest of Chairmen and Directors in those in whom the future of the gas industry reposes. There is nothing wanting in the opportunities for work and for shouldering responsibility in the gas industry's field; but, taking a general survey, we cannot at present give to Directors and Committees the credit of doing much to attract into that field and to encourage young men of promising ability. The fact cannot be concealed that, in many gas-works to-day, the works' staffs are reduced, in the name of much-abused economy, to the narrowest possible limits, and assistants are paid salaries at which subordinates in rank who have to take instructions from them, in the absence of, and as deputy to, the Engineer, would and do sneer. But it is with these inappropriately remunerated young men that the President truly says the future of the industry lies; and we would point out to Boards of Directors and Committees that those young men ought not to be expected in the present to live upon, and to be stimulated only by, prospective opportunities, responsibilities, and honour. It is hard fare; and waiting indefinitely for fair reward is a weariness to the flesh and spirit.

In turn, however, it is open to the young men of the profession to offer their congratulations to those who commenced their "careers under different conditions from those "prevailing now," on the success that they have made of the opportunities the industry has—not spasmodically, but with, in the past quarter of a century, admirable regularity—unfolded to them, and of which success the Harrogate Gas Company is a luminous example. The works of the Company have always suffered drawbacks of situation. Nevertheless gas was being sold at 2s. 6·6d. and 2s. 4d. net last year; and the capital employed per 1000 cubic feet—13s. 10·6d.—although not quite down to the average of a number of the gas undertakings of first magnitude, is lower than the figure which several of those individual large concerns present. And the number of customers and the volume of business at Harrogate have also expanded at a remarkable rate, having regard to the fact that the town is a residential one and a holiday and health resort, and not a manufacturing place, with its congeries of dwellings for the industrial workers. Among the other interesting features of the business-developing methods of the Gas Company is one which is pertinent to the discussion that has been proceeding in our columns on the "Gas Heating Field." Since 1885, there has been in operation a system of differential rates of discount for gas used for power, cooking, or heating; and now for these purposes (deducting from the total output the gas sold through the prepayment and the weekly payment systems) there is consumed close upon 85 million cubic feet out of the balance of some 216 millions. This is very good, taking into consideration the character of the district. It is a view consonant with our own that the President takes, that, in these times of severe competition, the increased demand for purposes other than lighting is effective in maintaining a remunerative flow of gas through the mains which would otherwise be for most part unproductive during the hours of daylight. "This," as has also been frequently submitted in these columns, "operates beneficially from the carbonizing "point of view, and contributes, in a marked degree, to the "reduction of capital charges, and reacts to the benefit of the "gas consumer by producing conditions favourable to the "reduction in the price of gas."

From an engineering point of view, the portion of the address where the President dealt with the difficulties attaching to the unsuitable site of the Harrogate Gas-Works, combined with the growing business and the consequent increase in the weight and bulk of material that has to be transported to them, was most attractive. It has been a very difficult

problem, involving substantial cost, with which the Directors and their Engineer have been confronted; and the alternatives were the transference of the gas-works to a site near the railway, or the construction of a light railway of 1½ miles in length (a considerable part of which is to be in tunnel) linking up the Railway Company's system with the works. The latter has been considered, under all the circumstances, the better solution; but beyond the one statement that the construction of new works in proximity to the railway was deemed to be too costly in character, especially having regard to the loss of capital by the abandonment of the existing works, the President does not impart information to enable others to form any judgment as to which would have been their choice under like circumstances. The cost of the reconstruction of works on a new site is not entirely a charge upon capital; in part, through the supersession of the old works, it would be in the nature of a renewal. Against whatever cost would be incurred in establishing new works, the alternative scheme involves a capital expenditure that cannot be by any means a light one, and there is in addition the perpetual running, labour, and maintenance charges over and above the cost of receiving into, and removing from, a works located alongside a railway the materials, and which charges must grow heavier as business increases. Of course, one cannot write decisively, but only suggestively, upon a question such as this without the full details at command; but there are some instances at hand—notably among recent examples Granton, Hastings, and Wellingborough—where transferences of the manufacturing operations have, through the economies realized, proved profitable investments.

The only paper read at the meeting, and in all respects it presented a sufficiency of technical matter, was one by Mr. J. C. Angus, of York; and in it he gave a good *résumé* of the comparative development of gas and electricity as illuminants. In doing so, he lifted the subject from the plain, practical level of ordinary consideration to a more scientific line of reasoning. He presented truths accepted by all who are untrammelled by professional interest which demands the advocacy of lights of high candle, but relatively low diffusive, power, which truths are crystallized in the statements that high candle power does not represent the attainment of good lighting, that there is much misapplication of artificial light, and that that misapplication represents actual waste. We are quite in accord with Mr. Angus that the greatest candle power for the least cost has become an aim without consideration for the physiological factor that should (though it is not always allowed to) govern it; a smaller candle power for the same cost, but with a better illuminating effect, being much more difficult to understand. But in this matter of the correct application of artifical illuminants, the fundamental scientific principles which should govern have unfortunately to give way to the requirements of the public; in other words, in the struggle between those fundamental scientific principles and commercial necessity which is governed by the behests of (in illumination) an uneducated and self-willed public, it is an unfortunate confession to have to make that the fundamental scientific principles have to take second place. But there is consolation in knowing that the cheapest and most efficient source of illumination—the incandescent gas mantle—is physiologically superior to such intense radiant light sources as the electric arc and electric incandescent filament lamps. The author accords much praise to the improvement in mantle production, which has so enormously increased illuminating efficiency; but in this connection he seemingly neglects the steady improvement that there has been in the burner by which the efficiency of the mantle has been so greatly enhanced. To the professional lighting engineer, there is, of course, much interest in learning the approximate intensity in candles per square inch of light sources; but to the man in the street, such a comparison would be very confusing and misleading. In the later part of the paper, however, Mr Angus descends to the more practical aspects of his subject in dealing with the comparative efficiency and cost of the new metallic lamps, against which is placed the bijou inverted gas light. The lamp that at present is most applicable to home conditions of electricity supply is the Tantalum (used in most places in pairs through higher voltages obtaining than the lamps are capable singly of standing); and the author's curve of the candle power distribution of this lamp in comparison with that of the small inverted lamp shows that there is little to choose between them. In cost, however, the economy is greatly on the side of the latter. In matter and composition, the paper is an excellent one; and it will well repay very close study.

The American Investigation into Company and Municipal Ownership.

From America there came to our shores some time ago a Committee appointed by the National Civic Federation Commission on Public Ownership and Operation. The purpose of the Committee was to investigate the methods and results of municipal and private ownership of public supplies. Much money was spent, and much time occupied; and the result is that the report of the majority is such a jumble of conclusion and misapprehension that we fear the light and leading are not of the determinate character expected by those who originated the investigation, and it will be properly considered that the value received is not fair compensation for the time and money expenditure involved. We cannot say, after a careful perusal of the majority report, that it is anything more than an attempt on the part of the blind to lead those who were striving after clearer vision on the subject in question. The Committee warn against the difficulties and dangers attending municipal trading; but they do not in set terms condemn or commend. They decline, in fact, to give any positive answer of universal application as to whether municipal trading has been a success or a failure compared with private ownership. Throughout the report there is every manifestation of a sneaking favour towards municipalization; but the absence of positive evidence, excepting in isolated cases, deters the Committee from proclaiming their favour too explicitly.

For instance, we find the Committee asserting that many municipal electricity plants have had to struggle to exist, in the face of unsympathetic public opinion. In this country, public opinion has been very indulgent towards such plants; and the ratepayers have been uncomplaining, until their burdens reached such extremes that they began to look for the causes which produced for them such painful effects. Then came the awakening; and then, and not till then, was the general public unsympathetic. Among the dicta of the majority, we find that no municipal ownership should be undertaken solely for profit; but take away the glitter of profit, and, in this socialistic age, municipalization is robbed of its chief attraction. The report recommends that local authorities should be allowed to enter into municipal ownership "upon popular vote under reasonable regulation." But later on there is a recommendation, without any question of "popular vote," that all future grants to private companies for the construction and operation of public utilities should be terminable after a certain fixed period, and that meanwhile cities should have the right to purchase the property for operation, lease, or sale, paying its fair value. So that the literal meaning of this is that, whether or not the public desire municipal ownership, the municipality should have the right to enter into possession, at a price, at the end of a specified term. The report also recommends that private enterprise in public services should be subject to regulation and profit-sharing with the municipality. Against fair regulation we have nothing to say; but profit-sharing with a municipality has the most potent effect in maintaining at a higher figure than is necessary the price of a commodity to the consumer. It was so with gas in Paris; it would be so in America. And all the restriction imposed by defining the term of the active life of companies would also be to the detriment of the consumer. In these respects, the Committee have certainly not looked at the matters confided to their investigation from the point of view of the public with that thoroughness that might have been anticipated.

There is something very narrow-minded, too, about their opinion that the most effective way of protecting the rights of the people is for the various States to give to the municipalities authority, upon popular vote and reasonable regulations, "to build and operate public utilities, or to build and "lease the same, or to take over works already constructed. "In no other way," add the majority, "can the people be "put upon a fair trading basis, and obtain from the indivi- "dual companies such rights as they ought to have." It is believed by the majority that this provision will tend to make it to the self-interest of the "public-utility companies" to furnish adequate service upon fair terms, and so render it unnecessary for the public to take over the existing utilities, or to acquire any new ones. In other words, the proposal is that the sword of Damocles shall hang over companies to keep them abreast of their duties! The idea is eloquent of short-sightedness. Is there "no other way"? We think that there is; and it is to be found in the report of the minority, in which Mr. Walton Clark, the Vice-President of the

United Gas Improvement Company, advocates State regulation of private enterprise in public services, included in which regulation, so far as gas and electricity supplies are concerned, might be the application of the sliding-scale of price and dividend. The sliding-scale has proved successful, remark the majority, in "some" cases in England; but they do not favour us with any intelligence as to the places where it has not proved successful. Though the majority suggest the tight-lacing of companies rendering public service (which tight-lacing promotes an unhealthy condition of system) and a strict surveillance over their doings, we find no suggestion in the report as to surveillance over the acts of municipalities—and in America, the whole world knows, they do require some surveillance—to see that they comport themselves in a becoming manner in the conduct of their undertakings, and do not violate the legal and moral regulations under which they are supposed to work.

The report we must accept as being the sum of the conclusions of the majority of the Committee after their inquiry; but are these conclusions representative of a fair judgment on the evidence laid before them? We have excellent reasons for doubts. The impression the reading of the document has left upon us is that it is a peculiar and confused mass of conflicting views and recommendations; and that it is useless as a definite, trustworthy guide for those who had hopefully looked for direction as the result of the investigation.

Architects and Gas Heating.

We are informed by Mr. Walter T. Dunn that the suggestion made by our correspondent "Radiation" in last week's issue, and commented upon in a leaderette—to the effect that a conference on the subject of gas heating should be arranged with the architectural organizations, and that the Gas-Fire Investigation Committee of the Institution should extend the scope of their inquiry into the matters recently raised in our columns—came before a Committee of the Council of the Institution last Tuesday, when it was arranged that the matter should be placed on the *agenda* for consideration by the Council at their next meeting. It will also be seen by a letter from Mr. Arthur L. Griffith, in our "Correspondence" columns this week, that the Society of British Gas Industries have had this question before them for some weeks, and preliminaries have already been entered into with the architects for a conference, which it was hoped could have been held this autumn, but the time has been found to be inconvenient. It appears that it was the intention of the Council of the Society to ask for the co-operation of the Institution of Gas Engineers, as soon as that of the architects had been definitely secured. Naturally any suggestion from the Institution would be welcomed at this stage by the Society. We hope the Council of the Institution will be in a position to mature the suggestions that have been made, as there appears to be in them the opportunity for doing a good service to both the gas industry and the public. In developing the use of gas for heating, we know of no body of men whose co-operation is more to be desired than the architects.

Will there be a Railway Strike?

That is the question that is in everyone's mouth at the moment; but it is the question that no one can answer. Our last reference to the subject was a fortnight ago. A few days later, there appeared to be a distinct weakening of the position of the Amalgamated Society of Railway Servants; and signs were not wanting that Mr. Bell, and those working with him, were getting somewhat anxious over the trend of affairs. Mr. Bell, indeed, went so far as to say that, if there was to be a strike, it would not be immediately. Since then there have been two significant incidents in the course of events. The first is that the Railway Companies' Association have officially announced that Mr. Bell's letter on the subject of recognition has been put on the *agenda* for consideration, and the second is that an attempt is now being made to secure the federation of the five railway labour unions. If this can be effected, it will make a powerful difference in the relative positions of the parties. On the proposal, a conference of delegates from the several Unions was held last Saturday in Manchester; but nothing definite was done—the sum-total of deliberation being a resolution approving of the principle of federation. The delegate of the Amalgamated Society was not present in a representative capacity; and, on that ground, the proceedings were adjourned to Oct. 19. Regarding the point of recognition, there appears to be no good case on which the Unions can found their claim; and there is certainly no ground for the interposition of third parties between the Companies and their men. It is not only the present, but the future that has to be looked to. So sure as there is recognition in the present, so sure will the railway world be, with uncomfortable frequency, in a state of ebullition in future. So sure, too, as there is recognition in the present, so sure, too, will the cost of carriage be increased, to the injury of industry and the whole country. Since the North-Eastern Railway Company "recognized" the Unions, they have hardly known a peaceful moment; and their experience is but the miniature of what will be that of the larger railway systems if the Unions are recognized by the Directors. It is said in support of the claim of the Unions to recognition, that there is unrest and discontent among the men, and that they are oppressed, and redress is not possible under existing circumstances. Till the Union leaders said this, many of the men were totally unaware they were suffering in this painful way, and were congratulating themselves that they lived in times when, compared with a past day, their conditions show a marked improvement, and with a future not so dark as that of many workers in other fields. After the threats that have been made by the Amalgamated Society of Railway Servants, we cannot think that the Companies are altogether unprepared for a suspension of active work on the part of those of their own men who are unionists.

A Study in Gas Manufacture.

In another part of the "JOURNAL" will be found the text of a paper presented at the last meeting of the Michigan Gas Association by Messrs. Alfred H. White and Frederick E. Park, giving an account of their investigations on the subject of gas manufacture. As our readers may remember, the Association support a "Fellowship in Gas Engineering" in the University of Michigan; and the paper referred to, one of the authors of which (Mr. Park) is the holder of the Fellowship for 1906-7, is the seventh to be presented as a result of this support. Last year, the Association sanctioned the erection of experimental plant in connection with the works of the Ann Arbor Gas Company; and the paper is in the nature of a preliminary report of its operation. In addition to describing the plant, the authors give details of two tests made on one kind of coal, carbonized in the same retort for a four-hour period at approximately the same temperatures. In one test the charge was 470 lbs., and in the other 350 lbs.; and the progress of the carbonization and the action of the condensing system are traced at half-hour intervals. The authors do not claim that any general conclusion can be drawn from their tests; but they are presented as an interesting illustration of the differences that may arise. It is pointed out in the summary that the great number of "variables" which enter into experiments of this sort make it almost impossible to decide what phenomena are produced by purely local and incidental conditions, and what results are typical and may always be expected to appear with given conditions; and the authors think it may be possible for men whose duty makes it necessary for them to puzzle every day over such obscure factors, to say how far the various phenomena noted may be general or accidental. They left the matter in the hands of their colleagues for discussion; and we leave it to our readers' consideration.

Concerning Municipal Finance.

Mr. W. B. Peat is the President this year of the Institute of Chartered Accountants. The position he occupies in the City is a high one, and on him has recently been conferred the honour of selection by the London County Council to undertake the vast and responsible task of investigating the financial affairs of the Metropolis. But to our readers his name is familiar as that of the Secretary of the Cagliari Gas and Water Company, Limited. As President of the Institute of Chartered Accountants, Mr. Peat delivered his address to the members last week. Municipal accountancy was his salient topic; and present in the address are all the indications of an extensive and deep study of the many problems clustering about the vexed subjects of municipal finance and trading. In twenty years, municipal indebtedness has increased by the enormous sum of 276 millions—that is to

say, from 193 millions in 1884 to 469 millions in 1904; and therefore to the ratepayers, and to the country generally, it is of vital importance that there should be proper disbursement and proper method in financial dealings, with the highest intelligence and competence brought to bear upon them. Something to this effect was the standpoint from which Mr. Peat approached his subject; and in his address local authorities will find many words of wisdom forming principles which it would be profitable for them to adopt where they have not already done so. Among many other things, he holds that unproductive expenditure should not increase in greater ratio than the wealth of the population and the rateable value of a town; otherwise, serious injury may be inflicted on the inhabitants. He also strongly urges that adequate sums should be set aside for depreciation and possible obsolescence; for if provision for repairs and renewals be neglected in the earlier stages of the life of an undertaking, the burden would be simply transferred to the shoulders of succeeding generations of ratepayers. Mr. Peat was eloquent in his pleading for the universal application to local finance of a commercial audit.

The Commercial Audit.

The need for a "commercial audit" of municipal accounts has long been recognized in many quarters, and has often been referred to by speakers who understand their subject. What an accountant of the position of Mr. Peat had to say on the matter is therefore of interest. If, he remarked, a commercial audit was necessary for a public company for the benefit of the shareholders, who changed from day to day and sold out or bought as circumstances pleased them, and where the market prices of shares reflected the prosperity or adversity of the concern, how much more necessary was it that the ratepayers, who could not leave their surroundings, should have information, and be in a position to criticize those who had the management of municipal affairs. They were familiar with, and adopted, the theory that the auditor could not direct the policy or appoint the management of an institution; but he could, and ought to, state that capital expenditure had, or had not, been allocated to the proper account, and that revenue had borne a fair proportion of all proper charges, so that every material information which an owner ought to have would be available for the ratepayers. He pointed out that in a commercial enterprise they had a balance-sheet and profit and loss account circulated to the owners, and asked why the balance-sheet and profit and loss account of a municipal enterprise should not be prepared and be as easily available for the ratepayers as the demand-notes of the rate-collector. Why not, indeed. Certain it is that if the ratepayers generally would thoroughly interest themselves in local affairs, they would be satisfied with nothing less than an audit based on the recommendations of the Joint Committee on Municipal Trading of 1900. This was what Mr. Peat advocated, after pointing out that local authorities had become traders in tramways, steamboats, fire insurances, electrical works, water, gas, telephones, industrial dwellings, milk supply, slab making, and contracting, and were now acting as bankers. The list could, it may be remarked, have been extended even beyond this.

The London and Southern District Junior Gas Association will hold the opening meeting for the session at the Cripplegate Institute next Friday. The proceedings will commence with an address by the President, Mr. W. Upton, which will be followed by an address by Mr. F. W. Goodenough, of the Gaslight and Coke Company. Arrangements have also been made for the members to pay a visit to the Wandsworth Gas-Works on Saturday, the 19th inst.

The Expenditure of the London County Council.—At the meeting of the London County Council to-day (the first after the summer recess), the Finance Committee will ask the Council to instruct the General Purposes Committee to so amend the Standing Orders that they will provide, among other things, for the regular discussion of financial policy on the annual estimates. The Committee have prepared a return showing the expenditure from April 1, 1906, to March 31, 1907, under the various votes on rate and revenue and capital accounts. It shows that on rate accounts in respect of services not revenue producing the total votes, including supplemental and special votes, amounted to £10,086,062, and the total expenditure amounted to £9,614,392; so that the expenditure fell short of the estimate by £471,670. On accounts in respect of revenue-producing undertakings, the total votes amounted to £1,221,813, and the total expenditure was £1,212,760.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 124.)

Business on the Stock Exchange last week was better, and a considerable improvement in tone was witnessed. The most prominent feature was the gratifying indication that the long-ruling depression in Consols and securities of the highest class is coming to an end. Why it should ever have attained the proportions it did, is a puzzle to many; but there seems nowadays to be a tendency to overdo things when once they start. On the opening day, there was no sign of amelioration. Consols fell ¼; Home Rails were down; and generally the other departments were flattish. But on Tuesday the tide began to flow, and prices steadied at the sight of some buying orders. There was one small failure; but it was not noticed. On Wednesday, the improvement in the best lines made progress; but the more speculative class did not participate. The general position next day was much the same, owing to various troublesome elements—*e.g.*, the Copper Market and some speculative liquidations. But on Friday all the crumpled roseleaves appeared to be smoothed out; buying went strong; and Consols made the big advance of ½. The situation was well maintained on Saturday; and the bright week had a bright end. Consols touched 83¼, which is within the merest fraction of a 3 per cent. price. In the Money Market, there was a good demand fairly even through the week at firm rates, and discount was rather inclined to harden. Business in the Gas Market was on a wider scale, marking the close of the holiday season. The general attitude of stocks was very firm; for, although not many quotations were varied, all movements were in the upward direction. There are signs on the Coal Exchange of a check to recent big advances in price—perhaps even of a reaction; and if these should be accentuated, the Gas Market should benefit. In the Gaslight and Coke issues, the ordinary was pretty busy, and after a bit it rose a point—transactions ranging from 94¼ to 95¼. The secured issues were quiet. The maximum changed hands at 86; the preference at from 105 (free) to 107; and the debenture at 82 and 83¾. South Metropolitan was active and unchanged, marking from 119½ to 120½; and the debenture was done at 81½. Commercials were very quiet. The 4 per cent. marked 102 and 103¼; and the 3¼ per cent., 101. In the Suburban and Provincial group, Alliance was done at 21¼ (a rise of ½), Brighton original at 218, British at 41 and 40⅞, Bromley "A" at 118, Bournemouth "B" at 16⅞ and 17, Tottenham "B" at 101⅛ and 102½, and West Ham at 103 and 103½. In the Continental Companies, Imperial was more active at prices ranging from 175¼ special to 176½. Union preference marked 140⅞; and European part-paid 18¼. Among the undertakings of the remoter world, Buenos Ayres was done at 11 1/16 and 11¼, Monte Video at 10¾, Primitiva at 6 3/32 and 6 15/16, ditto preference at 5 1/16 and 5⅛, River Plate at 13½ and 13⅝, and Oriental at 143.

ELECTRIC LIGHTING MEMORANDA.

Coal and Electricity Prices—How the Electrical Press Regards the Effect of Coal Costs on the Gas Industry—A Few Admissions—The Osram Lamp Challenged—Charges for Rates and Taxes.

Our recent reference in the "Memoranda" to the question of the cost of coal and its effect on electricity supply has aroused the "Electrician" into making a few caustic observations regarding our "prophetic picture" being painted in somewhat "mournful colours," and as to the tackling of the subject presumably having required on our part "a considerable amount of courage," seeing that "it is surely obvious that the gas undertakings will feel the effects of a rise in the price of coal much more severely than their electrical competitors." Then after this we are patted on the back by our contemporary for being about correct in our assertions. Therefore, between the first part of the editorial and the latter part, there seems to have been a little interruption of consecutive thought. We will not, however, make much of that, but will leave the prefatory remarks of our contemporary with a word of regret that the time of the writer of its comments is so monopolized that he has evidently only had time to glance at the notes in the "Journal" comprising the "Memoranda," and so has not seen that the rise in the price of coal and its effect upon gas prices has been a leading topic in our editorial columns since the early part of the year until quite recently. Upon that point, let us say at once that many gas undertakings whose prices have been low, and who have not accumulated surpluses, have, though to their regret, already increased the price of gas, notwithstanding the competition of electricity. In passing, we note that "Meteor" of the "Electrical Times" is not aware of this; for he says that it goes without saying that, if gas were not being "outstripped" by a serious competitor like electricity, the Gaslight and Coke Company would have put 3d. or 6d. on to the price of gas with the greatest equanimity. We do not know what "Meteor" means about gas being "outstripped" by electricity; for official statistics do not confirm the statement. But it is "Meteor's" wont to be somewhat capricious in expression. Those gas companies who have good revenue balances in hand, and who are refraining from raising the price of gas though the cost of coal has increased, have an eye as much to the effect in the matter of reduced dividends

under the operation of the sliding-scale as to the competition of electricity. "Meteor's" knowledge of gas politics assuredly requires bringing up to date.

To return to the "Electrician." It is said that "coal is responsible for only a small proportion of the *total* costs of electricity supply." Granted. But coal is not a small proportion of the *works* costs, and works costs have a most important bearing on the charges for electricity for power, heating, and uses other than lighting. Then our usually careful contemporary rushes off into a very rash statement. It says that "in the case of the gas undertakings, coal plays a much more important part—say about three-fourths of the manufacturing costs, or more than half of the total costs (including capital charges)." Now if our contemporary had said that the *gross* cost of coal represented about two-thirds of the manufacturing costs, or about half of the total working costs, and had said nothing about "including capital costs," we should have been tempted to believe that the writer knew something about the subject with which he was dealing. But what our contemporary has done is to treat the coal of gas manufacture as though it was burnt away under the steam-boilers of an electricity station—producing only gas instead of only steam. If the figures of the three London Gas Companies for 1906 are combined, it will be seen that of the total average expenditure on revenue account of 2s. 5·78d. per 1000 cubic feet of gas, coal and oil cost 1s. 1·38d. But from this 1s. 1·38d., has to be deducted, to obtain the net cost of the raw material, the average of 8·57d. per 1000 cubic feet received from residuals, which makes the net cost of coal and oil per 1000 cubic feet of gas, 4·81d. "It is evident," says the "Electrician," on gleefully contemplating its own presentment of the position of gas undertakings. "that a rise in the price of coal must affect the gas industry considerably more than the electrical, and consequently electrical engineers will gladly allow their gas competitors all the satisfaction they can obtain from such a rise." Now that we have revised our contemporary's representation of the position, we will leave it to extract from it whatever further comfort it can discover.

However, notwithstanding all the "Electrician" advances in the forepart of its article, it remarks: "There are some cases in which the price of coal will have a considerable effect on the cost of electricity supply—viz., where the price per unit has been based principally on running charges—*i.e.*, where it has been assumed that stand-by and capital charges are less important." That was precisely what was said in the "JOURNAL" remarks that inspired our contemporary to take up the subject; but that "*i.e.*" is really a beautifully mild way of referring to the piling up of the burden of charges other than running costs upon the lighting camel. The "Electrician" proceeds to refer to instances where the increases in the cost of coal must result seriously; so much so that it is suggested there should be a clause in contracts making the charge for electricity dependent upon the prevailing price of coal. Since reference to this matter was first made in the "Memoranda" for Aug. 27, there have been other incidental allusions to it in dealing with the accounts of municipal undertakings, many of which last year showed very narrow profits or deficits; while this year they, in common with other industrial undertakings, will be paying more for coal than last year.

The rise in the price of coal under contracts made in 1906 was small compared with the rise that has taken place this year; and last year's accounts show that several more municipal electricity undertakings would have been able to about make ends meet if it had not been for that rise. They will have to do much more business than they did last year to counterbalance the increased cost in the current one; and it must not be that short-hour, intermittent power business such as has in the past, when conditions were more generous, been taken on at absurd prices, and the losses on which have to be made up by the other consumers. In the case of companies, further observes the "Electrician," "the cost of coal will only affect dividends, but in the case of municipal undertakings working with only a small margin of profit—and, by the way, most of these undertakings desire to keep the margin small—the profit may be converted into a loss." It is a stretch of the imagination to say that most municipal undertakings desire "to keep the margin of profit small." With them it is a question of Hobson's choice. It was nothing but the vision of profits that made municipalities first rush into the electricity supply business. In many instances, although the undertakings have been established for years, the profits remain in the visionary state.

The General Electric Company, Limited, are pursuing their advertising of the Osram lamp by means of articles in the public press. These articles started in the "Daily Telegraph" and the "Standard." The same fount that then yielded the copious information is supplying other papers. In the "JOURNAL" on July 23 last, we exposed the stupid statements that were made as to the comparative costs of incandescent gas lighting and the Osram lamp; and Mr. L'ce Fletcher, of the Welsbach Company, has now had a shot at them, and goes further by issuing a challenge to the General Electric Company. It will be curious to see whether the Company will put their assertions to the proof on the conditions suggested by Mr. Fletcher. He says that, on behalf of the Welsbach Company, he is willing to instal a house throughout with the Welsbach-Kern No. 2 burner, using 2¼ cubic feet of gas an hour, if the General Electric Company will, on their part, instal a precisely similar house with their Osram light—the candle-power and consumption to be tested at intervals during a year by two independent experts—one gas and one electrical; and if this trial does not prove at the end of the year that, light for light, the Welsbach system, allowing for renewals at current prices, comes out *at less than one-half* the cost of the electric installation, the Welsbach Company will pay for the Electric Company's installation, and subscribe £25 to any charity the Company may nominate. If the contrary, the Electric Company are to pay for the gas installation, and pay over a like amount of money to some charity. The Welsbach Company have nominated Professor Vivian B. Lewes as their expert. Now it will be interesting to learn whether the General Electric Company will back up their words by deeds in the manner suggested. As they are so diligent in circulating their comparative cost statement, and as (according to the statement) the Osram lamp comes out so much in front of incandescent gas lighting, of course there is no reason why they should hestitate in getting all possible *kudos* out of the proposed trial. But the Welsbach Company have issued a similar challenge before in connection with carbon filament lamps; but no station engineer has yet had the courage to take it up.

In the Local Government Board's proposed form of revenue account for electricity supply undertakings, the following items are given under separate headings: (1) Rents, wayleaves, and easements; (2) rates and taxes. This division has suggested to Mr. H. E. M. Kensit, of East Molesey, that there might be a useful subdivision of the items by their allocation under the headings of "generation," "distribution," and "management and general." For example, rent, rates, and taxes on wayleaves for mains increase with the growth of the distribution system, and represent on a large system a considerable sum; and therefore, if the real total cost of distribution is to be ascertained, the amount of rents, rates and taxes appertaining to distribution should be charged direct under that heading, and not stand as a separate amount. That is what is submitted; and the idea is a good one. But we judge there would be one objection from the municipal point of view, that such a subdivision would show up, in still greater relief than now, the ridiculous assessments of many municipal electricity undertakings and the payments for rates and taxes. For instance, what would the £173 11s. 11d. charged for "rents, rates, taxes, and insurance" in the case of the Kingston-on-Thames undertaking (with its capital expenditure of £98,344) look like divided under the separate headings, or worse still, how would the £79 11s. 8d. charged for rates and taxes against the Gravesend electricity department (with its capital expenditure of £63,726) look when split up as suggested?

AIR GAS AT OLYMPIA.

AMONG the exhibits of interest to readers of the "JOURNAL" to which attention was directed in the notice which appeared a fortnight ago of the Engineering and Machinery Exhibition now being held at Olympia, was that of the National Air-Gas Company, which has been formed to work certain patents taken out by Mr. Glasscoe. Two plants are in operation in a building adjacent to the stand; and the resultant gas is utilized in both upright and inverted incandescent burners, in a heating stove, and in a muffle-furnace. The apparatus mainly consists of a hot-air engine, an air-blower, a vertical cylinder containing the supply of petrol, and a carburettor connected by a series of pipes and valves to a holder. The engine which drives the blower is actuated by a burner consuming gas produced by the apparatus. The air, after leaving the blower, is divided into two streams, one of which passes to a valve and the other direct to the carburettor. This air-valve (which is fitted with a thermostat) and the gas-valve from the carburettor communicate with a mixing-chamber, and are arranged to secure automatic control of the combined air and gas supplies; and it is claimed that "it is the combination of these new principles, automatic and thermostatic control and air-relief valve, that has resulted in the manufacture of a uniform gas, under varying conditions of demand and temperature." To replace the heat lost in vaporizing, and to keep the petrol of a normal specific gravity, the heated water from the cooling-jacket of the engine is circulated through a chamber underneath the carburettor. A patent burner fitted with a fine gauze head, and without any holes for the admission of air, has to be used for burning the gas, which is intended to be consumed at a low pressure. The gas produced by the system is composed of air which is said to be impregnated with only 1·48 per cent. of hydrocarbon vapour, and to be therefore non-explosive, non-poisonous, non-corrosive, non-asphyxiating, and to give off products of combustion which are inodorous. The plants are adjusted for use with commercial petrol (motor spirit), a gallon of which it is claimed will make 1600 cubic feet of gas having an illuminating efficiency, with an ordinary incandescent mantle, of 16,000 candle-power-hours. Many advantages are enumerated by the Company as belonging to the plant—not the least of which is in the matter of cost. On this point, it is stated that "with petrol at 1s. 1d. per gallon, the gas to supply 40 burners of 25-candle power each, or other burners having an aggregate of 1000-candle power, costs only four-fifths of a penny per hour." The comparison with the cost of coal gas which the Company make was referred to in our general notice of the Exhibition.

Mr. John Lancaster has resigned the position of Assistant Water Engineer to the Plymouth Corporation, to take up the post of Water and Sewage Engineer at Rangoon.

GAS ACTS FOR 1907.

SECOND ARTICLE.

THE further powers granted to Statutory Gas Companies are noticed this week.

The Basingstoke Gas Act shows there has been scarcely any alteration since the introduction of the Bill. A small piece of additional land is scheduled for works purposes; and, by agreement, the Company may acquire a further 3 acres. The capital is consolidated on a 5 per cent. basis. The holder of every £100 of original stock entitled to a maximum dividend of 10 per cent. per annum is to receive £200 of consolidated stock; the holder of £100 of 1887 new stock entitled to a maximum dividend of 7 per cent. per annum is to receive £140 of consolidated stock; and the holder of every £100 of original stock entitled to a maximum dividend of 5 per cent. is to receive £100 of consolidated stock. The authorized additional capital is £30,000, with one-third borrowing powers. A renewals fund is sanctioned. The standard price is to be 4s. per 1000 cubic feet of gas; and the sliding-scale is to operate half-yearly by 1s. 3d. per cent. on penny variations in price. The illuminating power is to be 14 candles, tested by the Metropolitan No. 2 burner and 10-candle pentane lamp. The model prepayment clauses appear; but the 10 and 15 per cent. discounts clause has been eliminated, and, in the first part of the Act, there has been inserted the extension of section 13 of the Gas-Works Clauses Act of 1847, providing that "every such contract entered into by the Company shall be alike in terms and amount, under like circumstances, to all consumers." [*Parliamentary Agents: Messrs. Torr and Co.*]

There has been a little modification in the Falmouth Gas Act; but not much. The Company have obtained power to purchase, by agreement, an additional 10 acres of land. Their capital powers are extended by £15,000, with one-third borrowing power. The dividend on the additional capital is not to be larger than 7 per cent. on the part issued as ordinary stock, and 5 per cent. (6 per cent. was mentioned in the Bill) on the preference stock. Section 61 of the Company's Act of 1890 has been repealed; and a standard price of 4s. appears in the Act, with a sliding-scale operating yearly, on the usual basis, for 10 and 7 per cent. capital. The illuminating power is 14 candles; and the new testing conditions apply. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Gas Companies (Removal of Sulphur Restrictions) Act is the second successful joint promotion under the auspices of the Gas Companies' Protection Association—following on legislation affecting London—whereby several Gas Companies have been relieved of liability for forfeiture or penalty for sulphur compounds other than sulphuretted hydrogen. The Companies are those of Bath, Blyth and Cowpen, Eastbourne, Scarborough, Tynemouth, West Ham, and Weymouth. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

In the Great Yarmouth Water-Works and Lowestoft Water and Gas Act (which chiefly refers to water supply), the Lowestoft Company have obtained the now common right, on the ordinary conditions, to contract with any local authority, company, or person beyond their limits of supply, for periods not exceeding in any case seven years from the making of the contract. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

There has been so little change made in the Act of the Maidstone Gas Company that a cursory glance at the provisions will suffice. The limits of supply have been extended so as to include several parishes and places within the Company's area; but the Company are not to exercise any of the powers conferred upon them for the supply of gas in the parishes of Chart-next-Sutton Valence, East Sutton, and Sutton Valance, or otherwise in relation thereto, unless or until they have acquired the undertaking of the Sutton Valence Gas Company, Limited. In the extended limits, the Company are allowed to charge a special rate of 6d. per 1000 cubic feet over and above the price charged under like circumstances to consumers outside the borough of Maidstone and a radius of 1½ miles from the Town Hall, Maidstone; but this price is not to be taken into consideration for the purpose of fixing the dividend payable. The Kent County Council, the Maidstone Corporation, and the South-Eastern and London, Chatham, and Dover Railway Companies have protecting clauses granted to them. The Company are relieved from penalty and forfeiture by reason of the presence in the gas of sulphur impurities other than sulphuretted hydrogen. The standard illuminating power of the gas is to be 14 candles, tested on the modern lines. Henceforth, any transfer of capital stock may be in multiples of £1, so long as by such transfer no holding of any proprietor is rendered less than £10 of stock. A renewals fund is provided. The Company have also secured the power to construct, within five years, a tramroad, 6 chains or thereabouts in length, connecting the South-Eastern and London, Chatham, and Dover Railway with the gas-works. The motive power, however, is to be animal only; the suggestion in the Bill as to the use of a winding engine or rope having been expunged. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

In the Mitcham and Wimbledon Gas Act, the land powers of the Company have been extended. The capital is to be consolidated on a 5 per cent. basis; but the Company are prohibited from converting borrowed money into capital. The additional capital authorized is not to exceed £240,000 (which is £60,000 less than requested in the Bill), with further borrowing powers not exceeding £15,000 in respect of the original and 1867 additional capital, and one-third of the additional capital created by the present Act. Insurance, renewals, and reserve funds are sanctioned. A standard price of 3s. 6d. was asked for in the Bill; it is 3s. 2d. in the Act, with sliding-scale operating half-yearly, on penny reductions or advances of the price of gas, by 1s. 3d. per cent. augmentation or decrease of dividend. The prepayment clauses are applied. The standard illuminating power of the gas is to be 14 candles, tested under the new conditions. The Company are to provide a testing-station in Wimbledon. It is also enacted that any gas examiner appointed under the provisions of the Gas-Works Clauses Act, 1871, by the local authority of any district within the limits of supply may, at the testing places, make testings of the gas to ascertain the calorific power, the illuminating power by a flat-flame burner which shall be of the best available pattern, and to be so used as to obtain from the gas the greatest amount of light, and the illuminating power by a burner fitted with an incandescent mantle, which burner and mantle are also to be of the best available pattern, and to be so used as to obtain from the gas the greatest amount of light. After making any such tests, the examiner is to deliver to the Company a report of the result; but the Company are not to be liable to forfeiture in respect of any testings made under the provisions of this section. The apparatus and materials necessary for the purpose of making these non-penalty tests are to be provided by the local authority by whom the gas examiner is appointed. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

All who followed the brave fight made by the Worthing Gas Company are aware that, by their Act, they have secured a new site at Goring for works; but round the margin of the land, except such portions of it as are specifically excluded, the Company are to plant non-deciduous trees, and cultivate and maintain them, so as to provide, as far as practicable, a screen round the lands. Powers to purchase lands by agreement up to 10 acres are allowed. The limits of supply are extended, so as to include the parishes of Durrington and Goring. Consolidation of the capital on a 5 per cent. basis is granted; but the powers of the Company are cancelled in respect of the issue of further shares or stock under their Order of 1904, save to the extent sufficient to produce £7000. Additional capital to the amount of £100,000 is authorized; with borrowing powers not exceeding (inclusive of the money already borrowed) one-third of the nominal amount of the ordinary stock into which the ordinary capital is consolidated, and one-third of the issued additional capital. The Company's powers of 1894 referring to the creation of insurance and reserve funds have been repealed; and funds (including renewals) are established on the ordinary lines. The terms of the sliding-scale clauses have been modified to meet the conditions brought about by the conversion of the capital. The Corporation of Worthing have obtained insertion of clauses for their protection. Within ten years, from the date that gas manufacture commences on the new site, the Company are to cease manufacturing gas at their existing works in the borough. From and after the expiration of three years, too, from the date when the Company commence to manufacture at Goring, if the clear profits in any year amount to a larger sum than is sufficient to pay dividends on the preference and ordinary stock, the excess, or such portion of it as is not carried to the credit of the insurance fund, is to be placed to the credit of the divisible profits for the next following year, until the amount so carried forward shall be equal to 6d. per 1000 cubic feet of gas sold in that year, in addition to the undivided profit up to the expiration of the aforesaid period of three years. Thereupon the Company are to reduce the price charged for gas, so that the sums carried to the credit of the divisible profits do not exceed the amount allowed by this provision. There is another clause which provides that, notwithstanding the discontinuance by the Company of the manufacture of gas upon the site of the existing works, they are to maintain and continue the present testing-place. [*Parliamentary Agents: Messrs. Dyson and Co.*]

Turning now to the Acts of Local Authorities in which there are references to gas powers, there is very little worth notice.

In the Brighouse Corporation Act, there is a section referring to gas and electricity; but the clauses are usual in present-day legislation. One clause denies to any person the right to demand from the Corporation a supply or the continuance of a supply of electrical energy for premises having a separate supply, unless he shall have previously agreed to pay the Corporation such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them to meet the possible maximum demand for the premises—the sum to be paid being determined, in default of agreement, by arbitration under the Electric Lighting Act, 1882. [*Parliamentary Agents: Messrs. Sharpe, Parker, Pritchards, Barham, and Lawford.*]

The proposal of the King's Norton and Northfield District Council to set up a testing-station within their district for testing the gas supplied by the Birmingham Corporation was rejected; and the section of the Kingston-upon-Hull Bill which contemplated the purchase of the East Hull Gas Company's works met a similar fate. The Penrith District Council Act contains a part referring to the gas undertaking; but the Parliamentary Agents have not a spare print of the Act, and therefore the provisions in which we are interested cannot be noticed.

The Pontypridd District Council Act contains a whole section

relating to the gas undertaking, comprising a number of modern clauses. The price to be charged for gas supplied by meter is not at any time to exceed 4s. per 1000 cubic feet for gas of a standard quality of 14 candles when tested under the new conditions. The clauses in the Council's Act of 1893 dealing with these matters are repealed. In the part of the Act alluding to finance, section 30 of the Act of 1893 is amended, so as to read, and have effect, as if the maximum amount the Council are authorized to set aside for a reserve fund were a sum not exceeding one-fifth of the aggregate capital expenditure for the time being upon the gas undertaking, instead of £3000. [*Parliamentary Agents: Messrs. Sharpe, Parker, Pritchards, Barham, and Lawford.*]

GAS AND ELECTRIC ILLUMINANTS.

No one who has made a study of artificial illumination can be ignorant of the fact that there are important features in connection with lighting problems which have nothing whatever to do with the mere question of their relative expense. Lighting agents have time after time been compared on the basis of cost, principally of that of the illuminant itself, and not infrequently on the score also of renewal of lamps and their auxiliaries. There are, however, other considerations which, though not absolutely ignored by those engaged in the practice of illumination, deserve, and should obtain, wider appreciation than they usually secure. Some of these were clearly brought to notice in the excellent paper contributed by Mr. J. C. Angus at the meeting last Saturday of the North of England Gas Managers' Association.

So far as cost is concerned, gas, in spite of electrical developments in decreased watts per candle, is still easily first. Figures like those of Mr. Angus have again and again been given to prove this; and, what is more to the purpose, concretre examples in the way of actual lighting accounts are readily obtainable, if needed, showing differences distinctly in favour of gas lighting. There are fortunately other advantages upon which gas engineers have reason to dwell—advantages which probably more than counterbalance those that are claimed for electric lighting. The alliterative claim of "convenience and cleanliness" is often heard in connection with the latter. The facility with which the electric glow lamp can be turned off is certainly a convenience, if regarded only from the standpoint of the consumer who desires to keep down his sufficiently heavy quarterly bill. Groping about in the dark while reaching for the switch is a detail, though not always so regarded by the nervous members of his household. The other advantage —cleanliness—is not altogether peculiar to electric lighting; and in these days of incandescent, and more especially inverted, gas-burners, it is to all intents and purposes attainable even by the poor consumer. In the matter of the effect of the competitive illuminants upon ventilation, gas again scores; and one has but to remember the useful information and data given by Professor Vivian B. Lewes at the recent Dublin meeting of the Gas Institution to feel armed with facts enormously in favour of the light with which gas engineers are concerned. These are points with which Mr. Angus did not deal in his critical comparison of the present-day development of gas and electric illuminants; but they very materially strengthen his case, and that of those who may use the information given in the paper in their public advocacy of gas.

Limited probably by a consideration for the time of the meeting, Mr. Angus confined himself more particularly to fads which, usually overlooked by lighting engineers, nevertheless merit close attention. These were clearly pointed out, and undoubtedly warranted his general contentions that, for every-day purposes, and in view of physiological needs, illumination should be of an evenly distributed character, and furnished by luminous sources of comparatively low brilliancy; and that, in this respect, gas engineers are particularly happy in having eminently suitable units for the purpose, with the further advantage that they can supply them at a cost with which the best forms of electric lamp cannot compete. In view of possible harm to eyesight, Mr. Angus laid stress upon the necessary attention which should be paid to the question of intrinsic brilliance; and with this we most certainly agree. High-power lights of great intensity have their use; but they may be, and often are, employed under conditions and in cases where the trying effect upon the eye would at once pronounce them as wrong, even if ordinary common sense had not previously suggested them as inadvisable. Mr. Angus said there could be little doubt that the continued strain and fatigue to which the eye is subjected when working with lights of great brilliancy, will in time produce results fraught with serious possibilities. Some reference was made to this in our columns a few months ago.*

The desire to get high yields of light per cubic foot of gas or unit of electricity is a natural and a right one from the economic standpoint. The development, however, is practically taking place in one direction only—that of increased light per unit of luminous surface. There are obviously fields for the employment of lights thus produced; and there is no reason for any discouragement of progress in this direction. Undoubtedly, the chief stimulus hitherto for the development of this form of intense light has been keen competition between, not only manufacturers, but the conflicting interests of the several lighting industries. It has been, as someone remarked, as if several bands were in contest, all acting on the assumption that the maximum of noise was the deciding element. Another factor contributing to the vogue in many instances of high-power lighting is probably the fact that great brilliancy suggests to the general public, ignorant of physiological matters, that this represents "the attainment of good lighting"—to use Mr. Angus's phrase. People are becoming unduly accustomed to, and like, brilliant illumination, and are apt to forget the real comfort and rest obtainable in the privacy of their own rooms with soft and low-intensity lighting.

While, however, the increased intrinsic brilliancy per surface unit of many forms of illuminants is not without its advantages for some purposes, there are many spheres in which development in this direction is not required, and is, indeed, distinctly inadvisable. There is room, therefore, in the various branches of the lighting industry, for an inventive ingenuity which, in obtaining greater duty per cubic foot of gas, unit of electricity, or of any other illuminant, will achieve a distribution rather than a concentration of the extra candles obtained. Apart from mere considerations of physiological requirements, it is evident that, for such purposes as Mr. Angus obviously had in view, the economy due to the greater duty or efficiency of a high-power light is all lost by the necessity for shading devices. It seems wasted inventive energy to obtain great intrinsic brilliancy which has to be shaded down to render it suitable for working purposes. Yet there are not a few examples of lamps on the market giving, by special burner devices, an increased duty of 10 to 20 per cent. with clear glass, but requiring opalescent or opal globes, which obscure much the same amount of light, in order to render them unobjectionable.

Again, Mr. Angus, in dealing with some of the fundamental principles governing the application of artificial illumination, reminds us that, after all, the important factor is not so much the intensity of light illuminating the object as the amount of light entering the eye from the object viewed. There is little benefit, therefore, to be derived from illuminants of great intensity, since the eye, physically unable to deal with their light, has to reduce the quantity by automatically closing the pupil. In order to gain visual efficiency, Mr. Angus suggests that the intrinsic brilliance of luminous sources must be "reduced so as to fall within such limits as the eye can accommodate without any undue retinal fatigue." It is in this matter that the gas industry is in a happy position, since it can readily meet the needs of the case. It possesses, in the ordinary incandescent burner, a cheap light, having a serviceable intrinsic brilliancy, which will allow, when fixed in its usual position above the head, of a good working illumination upon one's book or paper, and this without undue fatigue. At the same time, the industry is by no means handicapped for want of high-power lights, should these be required.

Electric globe lamps are usually fixed with clear glass; and, if employed in sufficient numbers to afford like illumination, present to the eye—to its discomfort—luminous surfaces of a higher intrinsic brilliancy than that of the gas-burner. The table of intrinsic brilliancies per square inch, both of various electric lamps and of incandescent gas-burners, shows clearly the difference between the two forms of illuminants. The relative brightness of the arc lamp renders its altitude when fixed a necessity; and then its light is discounted, if computed in foot-candles. The Nernst glower has also a comparatively high intrinsic brilliancy, and is consequently used with an obscured globe. The "Moore" vacuum light is instanced by Mr. Angus as more nearly complying with the requirement of low intrinsic brilliancy. It is not, however, yet a formidable competitor. The light is principally a golden yellow, and cannot be looked upon as ideal. It is true, a white light can be obtained; but in this case the effect is cold, and its efficiency is reduced by half. It is not practical for ordinary room lighting, and in case of breakage may be expensive to repair.

Mr. Angus states that it can be "generally accepted that the intelligent employment of lights of moderate candle power gives the most satisfactory results;" and he makes a point of the fact that the electrical engineer is now aiming at a lamp of about 25 candles—a unit which the gas engineer already possesses, and has every reason to make the most of. He is strongly in favour of the bijou inverted gas-burner, evidently preferring it to other sizes of incandescent burners. It is certainly a useful light; and two or three of these small units, when distributed on a pendant—in (say) an ordinary dining-room—afford a result, especially to tired or weak eyes, distinctly less fatiguing than a single 70 or 80 candle power burner, and infinitely less so than any electric lamp of similar candle power. We are not, however, disposed to discuss the form of incandescent gas-burner, vertical or inverted, to be preferred; for their serviceability from the several points of view enumerated must recommend them all. It is enough to reaffirm our faith in this form of lighting.

* See "JOURNAL," Vol. XCVII., p. 19.

In the notice of the Engineering and Machinery Exhibition which appeared in the "JOURNAL" for the 24th ult., reference was made to the exhibit of the Pulsometer Engineering Company, which comprised the largest and the smallest size of their steam-pumps—10 ft. 6 in. and 17 inches high respectively—capable of throwing 150,000 gallons and 1000 gallons of water per hour. It may be mentioned, in connection with this striking exhibit, that every size of pump, from the largest to the smallest, will work suspended on a chain, and, requiring no fixing, can be set in operation in the minimum of time. The Company have increased the height to which these pumps will deliver; and as two or more can be placed in series, the range of lift reached is very great.

LABOUR DISPUTES DURING THE PAST YEAR.

FOLLOWING close on the heels of the Board of Trade report on the Conciliation (Trade Disputes) Act, which was noticed in last week's "JOURNAL," there comes one the first part of which deals with the Strikes and Lock-Outs in the United Kingdom in 1906. Unlike the former document, however, which is issued every two years, the one now before us is an annual report, drawn up by Mr. A. Wilson Fox, of the Labour Department of the Board of Trade. In the matter of the relations between employers and employed, as with other questions, what is to come is, of course, of greater importance than that which is past; but at the same time it must be of assistance in gauging the possibilities of the future, to make a brief study of what has recently transpired. Though conciliation and strikes are far asunder in operation and in effect, they are so closely allied in application that they must needs be considered together. In fact, so much do they constitute one subject that Conciliation and Arbitration Boards, and Strikes and Lock-Outs, are dealt with by Mr. Fox in the same report; but it is the latter we wish to consider now—leaving the more agreeable portion for future notice.

Unfortunately, the present report (which is the nineteenth that has been issued) opens with the statement that the year 1906 was not so free from industrial disturbance as other recent years; while the aggregate duration of the disputes—about 3 million working days—was also somewhat higher than the average of the five previous years, which was about 2¾ million working days. The number of disputes which began last year was 486, as compared with 358 in 1905; while the number of workpeople affected both directly and indirectly in the two years was 217,773 and 93,503. These figures are not on the face of them very encouraging for those who are striving to promote the best interests of Capital and Labour. They are, however, in reality much better than they seem; for on going back a few years, and then making comparisons, it will be found that the average duration of disputes for each year in the period from 1896 to 1900 was a little over 7 million working days, as against the 3 million days last year, and the 2¾ million days in the preceding five years. From this fact, then, it is possible to derive some measure of encouragement. Even so recently as 1902, though the number of disputes (442) was somewhat smaller than last year, they were of greater magnitude; for the number of people affected was 256,667, and the aggregate duration of the disputes was close upon 3½ million working days. It is, however, the number of disputes that we like best to see diminish; for the principle is just the same whether the disturbance is long or short, and whether it affects a large or a small number of workpeople. And it is the principle of force that is at variance with the best interests of both employers and employed. This being so, it is gratifying to note that, while the number of disputes last year—486—is greater than in each of the preceding four years, it is far below any of the nine years before that. In 1894, there were 929 disputes; in 1896, 926; in 1898, 711; and in 1900, 648.

Coming to the different trades affected by industrial disputes, it is quite a surprise to find, after the experience of recent years, that mining and quarrying come as low down as third in the number of disputes, though the number of workpeople affected was once again a good deal ahead of any other trade. There were 125 disputes in the metal, engineering, and shipbuilding trades, 124 in the textile industry, 96 in mining and quarrying; while the figures regarding workpeople affected were respectively 42,049, 75,114, and 83,833; and the aggregate duration of the disputes in working days was (in the same order) 1,118,282, 762,999, and 922,102. The trades in which there was the smallest number of disputes (19), and also the smallest number of workpeople affected and the shortest aggregate duration, were building and transport (dock labourers, railway men, &c.). It is to be hoped that the agitation now in progress throughout the country will not result in the last-named division of workers losing in the next report the advantageous position that they in every respect hold in the present one. As to the building trade, the number of men affected by disputes has been declining for some time; and the figure for 1906 represents an extremely small proportion (no more than about 0·1 per cent.) of the total number engaged in the industry. Additional interest attaches to this fact, perhaps, when it is considered in conjunction with the remark in last week's "JOURNAL" that since the Conciliation (Trade Disputes) Act was passed, "the building trades have been well ahead as regards the number of cases in which the assistance of the Board of Trade has been sought" for the settlement of disputes. The proportion of coal miners affected by disputes last year was 9·4 per cent., as against 4·8 per cent. the preceding year, and 25·5 per cent. in 1902; the mean percentage for the period from 1902 to 1906 being 10·5. Over the same years, the next highest mean is in the textile trades—2·2 per cent. Taking all industries except agricultural labourers and seamen, the proportion of the total number involved in disputes in the period named was: 1902, 2·6 per cent.; 1903, 1·2 per cent.; 1904, 0·9 per cent.; 1905, 0·9 per cent.; 1906, 2·2 per cent.; mean, 1·6 per cent. The two classes excepted from these figures—agricultural labourers and seamen—are, of course, seldom affected by disputes; and therefore if they were included the proportion of the working population involved in industrial struggles would be materially lowered.

The aggregate number of working days available in the year for the whole industrial population (again excluding those employed in agriculture and at sea) is roughly estimated at 3000 million; and the aggregate duration of the disputes in 1906 (3,028,816 days) was not more than about one-thousandth of this total. Thus, spread over the entire working population, the amount of working time lost owing to disputes in 1906 was about one-third of a day per head. The average for the five years 1902 to 1906 was, it may be mentioned, about one-quarter of a day per head. If the loss had been apportioned in this equal manner throughout the working population, the suffering resulting would have been small enough. But, of course, it was not. The number of persons directly and indirectly affected by the 486 disputes which began last year was 217,773; and the 3 million odd days lost came to an appreciable amount per head. However, the disputes were mostly of short duration—much shorter than in the year 1905—no fewer than 206, or 42 per cent., involving nearly 34 per cent. of the total number of workpeople engaged in all the disputes of the year, having lasted less than one week. The proportion of disputes lasting under four weeks was 75 per cent., and of those lasting less than eight weeks 87 per cent. Only twelve, or 2½ per cent., lasted more than 25 weeks; but these accounted for 11 per cent. of the aggregate duration of all disputes commencing in 1906. Mr. Fox remarks that the greatest loss of time, which during the previous four years had been in the coal-mining industry, in 1906 occurred in the engineering and shipbuilding trades. In spite of this, however, the coal-mining industry last year accounted for rather more than one-quarter of the aggregate duration of all the disputes of the year, though this figure compares very favourably with that for 1905.

As to the causes of disputes, questions of remuneration once again accounted for more than half (55·7 per cent.) of the workpeople directly affected by all the disputes of the year. The general state of employment in 1906, it is remarked in the report, showed a substantial improvement compared with the previous year; and the effect of this is shown in the great increase in the number of workpeople involved in disputes which had for their object an advance in wages, and a considerable falling off in the number who struck against proposed reductions. Hours of labour also formed a fruitful source of dispute—the desire of employees to secure a reduction in working hours being much more pronounced than in the preceding four years. Another old acquaintance is seen in the disputes arising out of refusals to work with non-Union men, and other questions of Trade Union principle—the figures for 1906 being, Mr. Fox says, the highest on record. Of the 50,750 workpeople affected by such disputes last year, 45,995 were coal-miners in South Wales and Monmouthshire, where, as will be remembered, "peaceful persuasion" with the object of getting non-Unionists into the fold was largely—and successfully—adopted by the South Wales Miners' Federation. In disputes regarding advances of wages 14 per cent. of the workpeople obtained their demands, 38 per cent. did not, and 47 per cent. effected compromises. In cases of resistance to proposed reductions, the results were about evenly balanced between employers and employed; while questions of hours of labour generally ended in compromise. In the disputes over Trade Union principles, the workers, of course, scored largely. Mr. Fox remarks that, taking all the disputes of the year together, the proportion of workpeople successful in attaining their object was 42·5 per cent.; but if disputes affecting the employment of non-Unionists, which may be regarded as not directly concerning the employers to the same extent as other disputes, were excluded, the proportion would be materially reduced.

WATER-WORKS DISTRIBUTION.*

THIS volume is not only intended for the use of the engineer and superintendent immediately engaged in laying out water-works or remodelling water distribution plant generally, but is indispensable to everyone engaged or interested in water supply and up-to-date practice. The book will also be found extremely valuable to Town and Rural District Councils, Surveyors, and Medical Officers of Health, as guiding principles are dealt with by the author which, if properly observed, will secure a pure and efficient water supply; practical construction is well considered; the mechanical details being ably described and illustrated.

Since the publication of the first edition of the book, some important advances have been made in laying out new water-works; and it would add considerably to its value if, in the next edition, the author considered more fully the air-lift pump, the centrifugal high-pressure pump, and producer gas plant. Pumps and other forms of water-raising machines, hydraulic motors, lifts, hoists, &c., have also to be understood. As such appliances fairly come under the head of "Distribution," their construction and efficiency should receive the earliest and best attention, whether the supply of water comes from boring, well, or river. Armoured concrete pipes and covered reservoirs, &c., also call for notice. A few examples of works constructed for the purification of water supplies, new filters, and methods of cleaning, &c., would likewise be most acceptable to the distributing engineer.

* "Water-Works Distribution. A Practical Guide to the Laying Out of Systems of Distributing Mains for the Supply of Water to Cities and Towns." By J. A. M'Pherson, M.Inst.C.E., Chief Engineer of the Bristol Water-Works Company. Second Edition, Revised and Enlarged, with Additional Illustrations. London: B. T. Batsford; 1907. [Price 6s. net.]

In considering the laying out of a compound district of supply, the author has omitted the scheme of utilizing the whole of the low-service supply by passing it through a hydraulic engine (thus pumping a sufficient quantity of water to supply the higher districts) as is done at Brighton, Whitehaven, Wrexham, and elsewhere. This system is neglected in far too many instances that might be named.

The distributing engineer should not only possess a full knowledge of reservoirs, pumps, and mains, as well as of the methods of carrying out a water-works system, but he needs the aid of science to enable him to detect the presence of unobserved polluting influences, and to be competent to devise means for the thorough purification of the supply; also to ascertain if these means are positively effective and in absolute working order at every moment. He should likewise be able to deal with questions constantly arising in connection with the distribution of water—such as rates, rules and regulations, &c. Chapter 5 of the book is well written; referring to the measurement of water and regulating and recording apparatus of recent introduction. Kutter's formula is used for pipe discharges, which is fairly correct; but the present status of this problem is far from satisfactory. The author very wisely abstains from crowding his volume with mathematical formulæ, but confines himself strictly to describing the difficulties always met with, and the practical methods adopted to overcome them.

We are not aware that anything has been written on the subject of water-works engineering approaching this book in its practical value. All the details are worked out according to the most modern methods; every form of measuring apparatus required by the water engineer being fully described. The use of the Venturi meter, for measuring the exact rate at which filtration is proceeding continuously every hour of the day and night, and the rate of resistance offered by the filtering medium at the same time, is explained. This is the most valuable apparatus that can be installed on water-works; the diagram being always before the attendant, and every fluctuation, sluggishness, or clogging being automatically recorded, thus showing the exact time when cleaning is necessary.

As to the laying out of a town into low, middle, and high pressure zones and into waste-meter districts, the position and duplication of mains, the fixing of hydrants, &c., must be governed by local conditions and existing circumstances. The necessities of each town will determine the details of this system of distribution; the refinements described in the details of methods for arranging distributing mains being very difficult to be observed. Extensions are usually made when money can be found for the purpose and to meet the present needs; but the "Example Chart of a Distributing District" will be a valuable help to the engineer of an entirely new water-works, and an aid to those having to gradually convert an old into a modern system.

Nothing is being done in water engineering to-day which promises to be of more value in placing the profession in the highest rank than the designing of works on a systematic basis, with the object of reducing mortality by a scientific purification and filtration of the water supplied. The improvement in the death-rate shows clearly what a direct influence properly filtered water has on the public health. Details of various systems are hard to obtain; but much useful information, with illustrations and descriptions, is contained in the work under notice. A few sheets of tables of comparisons and statistics would have added greatly to its practical usefulness and value; also tables giving the variation in the consumption of water, showing that the maximum rate during the year exceeds, in the great majority of cases, the average by about 60 per cent.

The book is especially strong in examples with diagrams worked out to show how the methods advocated should be carried out. The summary of authorities is not numerous; but those given will enable the distributing engineer to verify the facts and extend his knowledge of the general principles on which water-works should be constructed. The book ought to be in the hands of every water engineer, distributing engineer, and all who are connected with, or responsible in any way for, the water supply of cities and towns.

The Position of Stands at the Manchester Gas Exhibition.—We learn from Mr. Walter Cawood, the Manager of the Exhibition, that some confusion has arisen from the publication of the plan and list of exhibitors in the last issue of the "JOURNAL." It may be explained that the numbers on the plan simply indicated the positions of the stands of the exhibitors named in our own list printed at the side of the plan, and were not the official numbers of the stands. For example, Messrs. Anderson and Duffield, whose position is shown by the figure 1 on the plan in the "JOURNAL," occupy Stand No. 47 in the Exhibition.

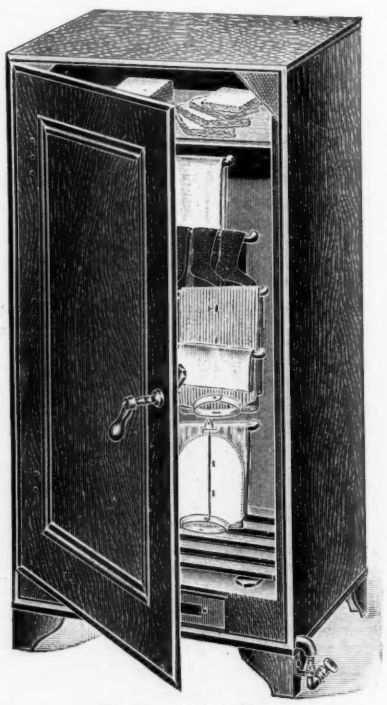
Scottish Junior Gas Association (Western District).—We learn from the Hon. Secretary (Mr. George Braidwood) that the annual general meeting of the Western District Section of the Association will be held in the Glasgow and West of Scotland Technical College, Glasgow, on Saturday evening next. Mr. James MacLeod, F.I.C., F.C.S., of Kirkintilloch, the outgoing President, will occupy the chair at the opening of the proceedings; and after the election of office-bearers and Council for the ensuing session, his successor—Mr. William Wilson, of Falkirk—will deliver his Inaugural Address, which will deal chiefly with reconstructional work.

NOVELTIES IN HEATING APPLIANCES.

(*Continued from p.* 35.)

Messrs. S. Clark and Co.

In the application of gas there appears to be no end. Messrs. S. Clark and Co. draw special attention to a new clothes-dryer, of which we give an illustration, and which they have recently patented, and purpose placing on the market at once. In this piece of household utility, they have succeeded in getting an even temperature throughout, by means of a special arrangement of burners, &c. The firm claim that this dryer is a distinct advance on anything of the kind yet produced. The whole is made of strong sheet-iron, enamelled inside, and grained and varnished outside. All fittings are of the finest quality and finish.



The New Clothes Dryer.

The "London" radiator is another speciality that Messrs. Clark and Co. are going to push this season. It is described as "an improved method of heat diffusion, combining the greatest economy of fuel with exceptional heating power." Further, we learn that, in this method, "by the retention and the subsequent circulation of the heat particles, healthy hot air only is emitted. The heated air is delivered from the lower part of the apparatus, and is diffused rapidly throughout the apartment—keeping the entire atmosphere in a state of circulation, and thus producing an even degree of temperature throughout. The temperature is rapidly raised, and it can be maintained or reduced as desired. No risk with water or steam is incurred, and connection with the gas supply only is required to put the radiator in action. The radiator being a pure heat generator, no flue is needed; and fixing of the stove is accomplished at the least possible expense." It is finished with polished steel tubes; the head and base being aluminium bronzed. The radiator is made with four, five, or eight tubes; the consumption of gas per hour being respectively 6, 9, and 12 cubic feet.

The "London" Radiator (Four Tubes.)

A Pocket Book of Electric Lighting and Heating.—We have received from Messrs. Crosby Lockwood and Son a handbook bearing the above title. It comprises useful formulæ, tables, data, and particulars of apparatus and appliances for the use of central station engineers, contractors, and engineers-in-charge, collected by Mr. Sydney F. Walker, R.N., M.I.E.E., &c. The text, which occupies 416 small pages, is illustrated by about 300 diagrams, &c. The price of the book is 7s. 6d. net.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Harrogate.

The Half-Yearly Meeting of the North of England Association was held at Harrogate on Saturday, when Mr. H. WILKINSON, of Harrogate, presided over a capital attendance of members and invited guests.

The PRESIDENT, at the outset, expressed his gratification at seeing so many members present at the meeting. It was, he said, very pleasing, and especially so when they took into consideration the fact that many of them had had to start from their homes so early.

Apologies having been read by Mr. HERBERT LEES, of Hexham (the Hon. Secretary of the Association), from several members who were unable to be present, Mr. William J. Smith, of Carlisle, was elected a member of the Association; and the following were elected Associates: Mr. Andrew Inness, Mr. William Garbutt, and Mr. Allan Burgess Roxburgh, all of the Newcastle and Gateshead Gas-Works; and Mr. Thomas Percy Ridley, of Whickham, Co. Durham.

THE MANCHESTER EXHIBITION.

The Secretary of the Manchester Institution of Gas Engineers (Mr. H. Kendrick, of Stretford) wrote inviting the members to attend the exhibition to be held in Manchester; and, after an expression of opinion by several of the members, it was decided by a show of hands that the members should make their own arrangements for visiting the exhibition.

THE PRESIDENTIAL ADDRESS.

Mr. WILKINSON then read his address, as follows:—

Gentlemen,—My first duty is to tender to you my thanks for the honour you have conferred upon me by electing me as your President. When I look at the roll of eminent men who have occupied the position, I feel how inadequately the duties can be fulfilled by myself; but having received such a marked indication of your confidence, it has been, and will be, my earnest desire to serve the interests of the Association to the best of my ability. It is a matter of deep interest to me, as it will be to every member and associate member, that a Past-President of this Association occupies at the present time the highest position which the Institution of Gas Engineers can confer—that of President; and I would offer to that gentleman our hearty congratulations.

I am deeply indebted to the Chairman and Directors of the Harrogate Gas Company for the opportunity of inviting you to hold this meeting here. The attractions of "Bonny Harrogate" are peculiarly fitted for what is essentially the summer (and therefore the pleasure) meeting of our Association; and I venture to hope that your visit here will be of a pleasant character.

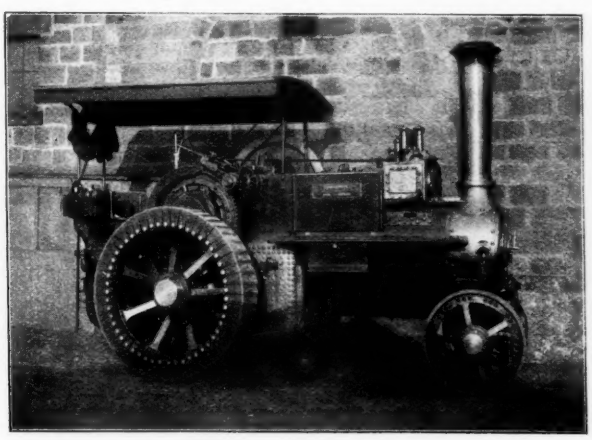
On the occasion of our last meeting in Newcastle, attention was directed to the important question of workmen's compensation; and the Committee had entrusted to them the duty of considering and reporting upon the matter. Their recommendations were duly submitted to you; and I venture to think that the steps taken by us were a contributing factor to the reduced rates which immediately after were offered by the Tariff Offices. The subject is one which claims still further consideration; and whether this be undertaken by the various Associations in their respective areas or by the Council of the Institution of Gas Engineers, the objective should be to obtain a reduction on the existing rates for insurance. And I doubt not that this will be accomplished.

I do not propose to submit particulars of the gas-works, for reasons stated further on; but will deal briefly with our latest scheme—the "Light Railway." After this, it may be of interest to give a few particulars and leading incidents of the development of the undertaking which I have had the honour to serve for 43 years.

THE GAS-WORKS.

As so recently as 1904 a graphic description of our works was given and published in the records of this Association, it is unnecessary on the present occasion to repeat it, especially as no new feature of manufacture has been introduced. I may, however, state that the coke-slaking arrangements which were in an experimental stage at that period, have proved so effectual that they have been adopted for the whole of our settings. As most of you are aware, the position of our works is far from an ideal one—being a long way from the railway. The promoters of the Company in 1846, however, were not responsible for the location of the works. They had practically "Hobson's choice;" and no doubt at the time, when a single cart more than sufficed to do all the leading required from Starbeck Station, the difficulties and disadvantages of having the works two or three miles from the station would not be regarded as a very serious matter. By 1870, however, when the tonnage had reached 2000, equal to 7 tons per working day, it was deemed necessary to have some more effective method of haulage than horse and cart; and one of Thompson's engines, with three wheels, india-rubber tyred, was purchased.

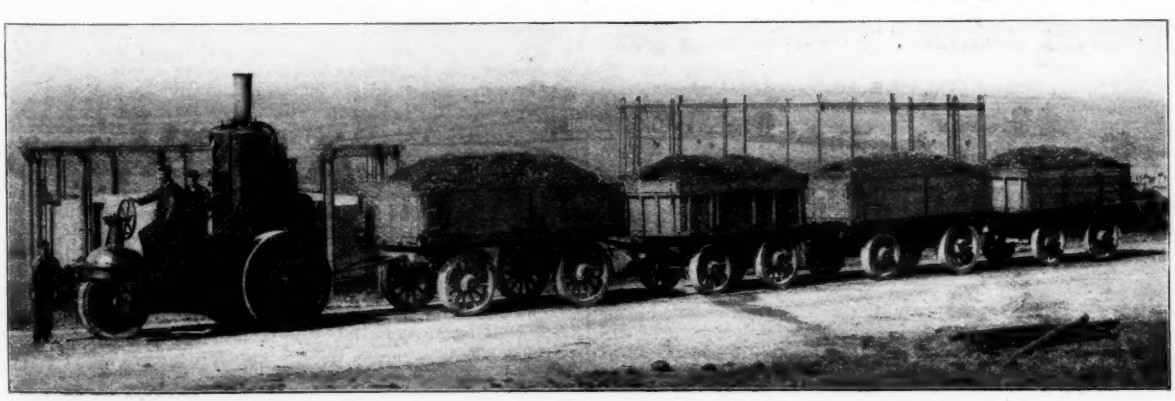
The distance to be travelled was so great that in 1880 an arrangement was made with the North-Eastern Railway Company for a siding at Bilton, reducing the distance of travel considerably. From this period forward the Company have had to contend with the cost of upkeep of a road 1466 yards in length, and



Burrell's 8-H. P. Double-Crank Compound Engine, with Wheels 5 ft. 6 in. in Diameter and having Rubber Tyers, 3½ inches thick, Shod with Steel Shoes, 4 in. by 16 in.

in addition, since 1893, have had to pay a considerable sum per annum for extraordinary traffic. In order to deal with the increasing quantities of coal and other material, a costly equipment of locomotives and waggons had to be provided. For instance, we have one of Burrell's 8 H.P. nominal double-crank compound engines, with wheels 7 ft. by 18 in., and shod with diagonal bars. A somewhat similar engine has wheels only 5 ft. 6 in. in diameter, and rubber tyres 3½ inches thick, shod with 4 in. by 16 in. steel shoes, giving increased tractive power, and preventing any slip of wheel when hauling. Vibration when travelling is reduced; and the cost of wear and tear of machinery is less. This type of wheel, however, does not comply with the "statutory requirements;" consequently a locomotive license cannot be obtained. But as we claim that it reduces the wear and tear of the roads, the County Council grant us permission to use the locomotive on the highways.

After 24 years' experience of haulage by locomotive, it must be regarded as a retrograde step on the part of the Directors



Thompson's Three-Wheeled Engine, With Rubber-Tyred Wheels.

to revert to the old method of haulage by horse and cart. There were, however, some special circumstances and conditions which favoured such a step; and all our traffic, with the exception of tar and liquor, has been dealt with in this old-time method—not always free from difficulties. With increasing traffic year by year the serious cost of haulage pressed heavily on us, and gave rise to consideration whether the works should be removed to the railway or the railway brought to the works; and the Directors have had various schemes in both directions submitted to them.

THE COMPANY'S LIGHT RAILWAY.

Here it will not be necessary to trace the various steps taken to solve the problem; but in 1903 Messrs. Newbigging and Son prepared an effective scheme for constructing works in proximity to the railway. It was, however, deemed to be of too costly a character, especially having regard to the loss of capital in the abandonment of the existing works; and the Directors, finding it practicable to deal with large traffic by light railway, invited Mr. E. W. Dixon, M.Inst.C.E., the Engineer of the Harrogate Roundhills Reservoir, who had had considerable railway experience, to prepare a scheme, upon presentation of which it was decided to proceed with it. Though its construction has only been in hand since April 25, you will find on your visit to the works something to interest you. By the courtesy of the Engineer, I am able to submit a few particulars of the scheme.

The Route.—Commencing at the existing Bilton Siding, the line passes in a westerly direction to Old Trough Lane, which is crossed by a steel girder bridge with masonry abutments, and then enters the tunnel just now under construction, finally coming to the surface on the Company's property. The gauge of the line will be 2 feet throughout, and the length about 1½ miles, 800 yards of which will be in tunnel. A system of sidings is intended to conveniently cope with the traffic in either direction. The main line sidings at Bilton will be considerably extended so as to accommodate 22 trucks. The coal will be dealt with through the existing shoots from the main line trucks at this point, and be discharged into specially constructed high-capacity waggons for the carriage on the narrow gauge; the coal being delivered into the existing coal store at an elevation sufficient to permit the maximum storage—the waggons being carried into it on an elevated railway constructed in steel work. The tunnel in the straight is 9 feet high by 8 feet wide inside diameter, horseshoe shape.

The Rolling Stock.—The rolling stock will consist of a suitably designed locomotive, about 20 tons in weight, capable of hauling 30 tons up to the maximum incline of 1 in 20. The engine will be approximately 100 H.P., and designed so as to be easily admitted into the tunnel. This engine is from Messrs. Thomas Green and Son, of Leeds, who have a very high reputation for this class of work. The waggons for dealing with the coal will be on the high-capacity main line principal from the design of Messrs. Sheffield and Twinboro, of Newcastle and London, constructed entirely of steel with double self-discharging hopper bottoms. They will have an overall length of about 25 feet, and be capable of carrying 10 tons of coal. The time occupied in discharging the whole of a main-line waggon at Bilton into a narrow gauge waggon will be 1½ to 2 minutes; and the same time will be necessary for discharging this quantity into the coal-store at Ripon Road.

The tar and liquor tanks will be accommodated for discharge at Bilton Siding at the existing dock upon an elevated railway; the tar or liquor falling by gravitation into the main-line tanks, obviating the necessity for any pumping.

The contract is let to Messrs. Holme and King, of Liverpool, who have had large experience in railway work; and it is expected that the line will be completed and open for traffic by the early part of 1908. Light railway traffic has been so extensively tested that there is no possible question about the line now being constructed being capable of dealing with a total annual traffic of 100,000 tons. Apart from the advantages the Directors hope to secure, it will be a great public boon to have such heavy traffic as ours removed from the public highway. We entertain the view that, when completed, we shall have one of the best—if not the best—equipped light railway and rolling stock in the kingdom.

PROGRESS OF THE HARROGATE GAS SUPPLY.

The Harrogate Gas Company, incorporated by Act of Parliament in 1846, with capital powers of £13,333, has three additional Acts or Board of Trade Orders. Combined, they authorize a share or stock capital of £188,071, and debenture or loan capital of £49,000, or a total of £237,071. The following table will convey some idea of the development of this local industry.

	Capital Expenditure.	Gas Sold.	No. of Meters.
1880 . .	£62,301 ..	38,958,100 cubic feet ..	1200
1890 . .	82,632 ..	93,860,000 ,, ..	2344
1900 . .	166,970 ..	226,255,600 ,, ..	6224
1906 . .	178,385 ..	257,451,500* ,, ..	8770

* Of this, 84,784,300 cubic feet are separately registered for gas-engines, gas cookers, and heaters, and 41,807,300 cubic feet for prepayment and weekly systems.

The capital per 1000 cubic feet of gas sold has been reduced from £1 11s. 10d. in 1880 to 13s. 10·6d. in 1906, and the price of gas from 4s. 7d. in 1880 to 2s. 6·6d. and 2s. 4d. net in 1906.

Had time permitted, the leading incidents connected with the progress of the Company would have been of interest. I will, however, confine my remarks to only one or two of those having far-reaching effect. In 1863, the Company commenced a gas-fittings business, believing that such would be beneficial to the consumer and to the interests of the undertaking. That these views had good foundation has been evidenced in all the succeeding years, and to-day we have an extensive and flourishing business. Quite apart from the profit derived therefrom, it enables the supplier of gas to follow his commodity to the point of combustion, and introduce apparatus, whether for light or other purposes, which will yield the best results, leading to the mutual satisfaction and benefit of buyer and seller.

Up to 1880, the demand for gas was almost entirely for illumination. In 1883 we commenced to hire out such cookers as were then in the market; and in 1885 a system of differential rates of discount was inaugurated, giving the advantage of an extra 10 per cent. discount for gas used for power, cooking, or heating, provided it was separately registered. By the end of the year the gas so registered equalled 9·4 per cent. of the total; by 1890, the percentage was 21·3; by 1900, it was 33·3; and by 1906, it was practically the same. Between 1900 and 1906, however, a powerful impetus had been given to gas consumption by the introduction of the slot meter, and free cookers and fittings under that system; and having regard to the fact that a large proportion of the gas passed through the slot meter is for cooking, and also that a very great number of gas appliances have their supply through the lighting meter, I have good grounds for estimating that 50 per cent. of our total output is for purposes other than lighting. So that we may claim to be actively engaged in the crusade against the smoke nuisance, and contributing to the purity of the atmosphere of this charming district. Our endeavour has been to make gas popular; and the measure of our success is indicated by the expansion of our business to its present dimensions.

THE GAS INDUSTRY OF THE COUNTRY.

We meet at a period when the gas industry is in a flourishing position, notwithstanding the keen competition met with in all directions. The increase in the gas consumption is very remarkable, and indicates not only the progressive methods adopted by the gas undertakings, but that gas holds its position in the estimation of the public. The Past-President of the Institution of Gas Engineers, in his address at the recent Dublin meeting, very truly represented this view when he stated "that the anxiety as to the position and prospects of the gas industry which was so widely felt for a considerable time, has gradually given way to a feeling of confidence with regard to them which is perhaps stronger to-day than has been the case at any former period." And the remark of Mr. Denny Lane, in his presidential address at the meeting of the Incorporated Gas Institute held in Belfast in 1893, when speaking of electric light, "that so far as we are concerned the new light, instead of being a star of ill omen, has been the harbinger of success," has been, after so many years, fully justified. This is shown by the parliamentary returns of gas undertakings in the United Kingdom—viz:

Gas consumed in	1890	94,645,613,186 cubic feet
,,	1906	161,407,725,000 ,, ,,

Or an increase of 70½ per cent.—a development which must be the envy of other commercial undertakings; and to us who are actually engaged in furthering the interests of gas undertakings, it may not be unprofitable to note some of the special features which have operated to make gas so popular.

Prominence must be given to altered methods of conducting business. The once neglected, and even despised, commercial department has been recognized as an indispensable one. The element of competition has been met with; and to combat this, the lethargic condition of years ago, fostered by the monopoly of supply and the provisions of Acts of Parliament, has had to give way to the energetic pushfulness of present-day business methods and cultivating new avenues for consumption, either in respect to the uses to which gas may be applied or in opening out trade with customers who previously found their requirements for light and heat met by other illuminants or fuel. How wide this field of operation has been is evidenced by the extraordinary development of the prepayment meter system, the advantages of which have been participated in by most gas undertakings. An extensive demand exists for gas for cooking and heating purposes; and while now a house is regarded as incomplete in its appointments if the gas cooker, boiler, and heating stoves are absent, it is not many years since these were little sought after. The use of gas for power purposes has also become a fruitful source of gas consumption; and the increased demand for purposes other than lighting is effective in maintaining a remunerative flow of gas through mains which would otherwise be unproductive during the day. This operates beneficially from the carbonizing point of view, and contributes in a marked degree to the reduction of capital charges, and reacts to the benefit of the gas consumer by producing conditions altogether favourable to the reduction in the price of gas.

The improved systems of lighting have done much to popularize gas. The advance in this direction has been of a remarkable character; and in these days it is difficult to believe that from the glimmer of the iron union jet, with 5 or 6 cubic feet of gas consumed per hour, we have now developments of light equal to 20 or 30 candles per cubic foot of gas—the resultant being more effective and greater intensity of light at diminished cost, with the attendant improvement in the atmospheric condition of our rooms. Indeed, so perfect is the consumption of the latest types of incandescent gas-burners that, from a hygienic point of view,

little is to be desired; and on the authority of Professor Lewes—quoting his own words—"A gas-lighted room will nearly always be more pleasant and healthy to live in than one lighted by the newer form of illuminant." This is an important pronouncement from such an eminent scientist.

There is much activity in the business of producing burners to yield the highest degree of efficiency per foot of gas consumed, and intensity of light is frequently obtained without regard to the effect that this may have upon the vision. This subject received much consideration from the late Mr. William Sugg. At the meeting of the Institution of Gas Engineers held in June, 1904, in London, he gave us the result of his vast experience in this direction. One passage may be appropriately reproduced. He said: "Reading out of doors in the strong, full daylight is not suitable for human eyes, and generally induces sleep; but if the same power of light is made to pass through glass the actinic power is very much reduced, although the glass may be clear. Therefore, in lighting schools it is much better, in the case of lighting for drawing, painting, or study, to allow the gas light to pass through glass; and this is especially so with regard to incandescent light." If attention is paid to this, and, where practicable, the point of intensity is shielded by an opalescent shade, the effect is restful to the eye without any diminution of light in the apartment.

Street Lighting.—Public lighting is a question of much importance, and claims some attention. In the sphere of public lighting gas has very successfully maintained its supremacy; and, as is evidenced by the records in the Technical Journals, it is most extensively used in the principal cities and towns of the country—some of the most noticeable cases being the cities of London, Liverpool, Bradford, and Sheffield. There, however, appears in some directions a disposition on the part of lighting authorities to introduce, irrespective of cost, the electric light. Having regard to the serious difference in the cost of lighting by electricity as compared with gas, one of the Local Government Board Inspectors stated at an inquiry at Newcastle last year that the Board had been refusing loans in connection with electric lighting; and Mr. Hunt, in his presidential address at Dublin, instanced several towns where the cost per mile for lighting by electricity was many times that of gas. And many lighting authorities appear to have recognized that, in the interests of efficiency and economy, incandescent gas lighting claims their serious attention. While gas has in the past so successfully met its competitor, there are directions in which much economy can still be effected by dispensing with the costly system of lighting and extinguishing. In the direction of automatic lighting and extinguishing of lamps, though there has been considerable attention directed to it, there is still a wide field for experiment; and the object to be attained is worthy of some special effort.

THE FUTURE OF THE INDUSTRY.

As the limitations of an address is determined by the time at one's disposal, and as this is circumscribed at a gathering such as this, many subjects of intense interest must be passed over. I have, however, the satisfaction of knowing that the experiences of the best part of a year in the varied developments of gas manufacture already appear in the technical records of the gas industry; and in regard to this I would only add that we await with anxious expectation the practical results of several of the new systems of carbonization of which we have heard much, and, in anticipation of the realization, have had happy dreams of the day when large yields per ton of coal are assured, carbonizing charges reduced, and the costs of repairs and maintainance are no longer features of anxiety to us, and the naphthalene will-o-the-wisp is banished for ever.

Meanwhile, we have to confront the solving of problems of gigantic proportions; and one of these is how to maintain the present low price of gas with the serious increased cost of coal. We each one have counted the cost to us; and no doubt our experiences are those of the majority, leading to the conclusion that this advance in coal imposes upon the gas industry of the United Kingdom an increased charge upon revenue of at least £1,448,000. This equals rather better than 2d. per 1000 cubic feet. Do the public realize this? As to how far this may be met by increased revenue from residuals is problematical; for apparently we can only reply upon the selling value of coke. Our hopes have been fixed in higher prices for tar and liquor; but in regard to the former the expectation that the demand for it in the direction of its use as a dust prevention would improve the market has not to any extent been realized. It is, however, a matter of satisfaction that the experimental stage of tar-spraying of the roads has passed; and there may be important developments in the near future. It is of interest locally, and no doubt generally, that, in this neighbourhood, the experiments of the Knaresbrough Rural District Council have been highly satisfactory. The Surveyor, Mr. J. H. Halstead, recently wrote to me that a portion of road treated in May, 1906, was, in March, 1907, "simply perfect, even when we had heavy falls of rain, and I am confident that the tar coating had a most valuable preservative effect on the road."

I must now draw my remarks to a conclusion by an appeal to every member of this important Association to foster well and further the interests of it to the utmost extent in his power; and this can be successfully carried out by placing your experiences—varied as is the number of members—before us when the meetings take place, thereby relieving our worthy Secretary of much anxiety as to how a programme shall be prepared. As one who commenced his career under different conditions to those prevailing now, may I offer to the younger members of the profession my congratulations upon the opportunities which are now presented to them and which, with strenuous effort, may open out to them positions of great responsibility, honour, and appropriate remuneration. The future of the gas industry is with you young men; and may your success be even greater than that it has been my pleasure to record of those in the past.

Mr. J. Hepworth (Edinburgh) proposed a vote of thanks to Mr. Wilkinson for his address. It would, he said, be difficult to express the feeling of gratitude they entertained to the President for his services rendered to them in his address. The President had given them one of the most interesting and able addresses he had had the pleasure of listening to for some time; and if the address might be taken as a photograph of the President, it would be a photograph of which the President himself might have reason to be proud. It showed the devotion that he must have applied to the interests of the Company he had now served for no less than 43 years. They had from time to time discussed many difficulties and heard of many engineering accomplishments; and to-day they had had placed before them something in a tangible form with respect to the conveyance of coal to gas-works some miles away from the railway. They had listened to the address with the greatest pleasure and interest, and they would be able after to-day to peruse it with increasing pleasure.

Mr. F. P. Tarratt (Darlington), in seconding the motion, referred to the able commercial manner in which Mr. Wilkinson had dealt with the competitive light they had to face—electricity. They could not help but realize that in a town like Harrogate there was every inducement and every opportunity for the Corporation electricity department to push their business; but the President appeared to have been able to cope with the competition, and had certainly grappled with it in a very efficient manner. Notwithstanding that Harrogate was such an up-to-date town, the progress of the gas undertaking was thriving more than it did in many of the towns that they were privileged to visit from time to time.

Mr. W. Hardie (North Shields) supported the vote. He referred to the fact that in his district the Local Government Board had written to know why application had been made for money for the more expensive light; and he said that at the present time the Corporation of Tynemouth had received permission for a loan of £4000 for the purpose of increasing the number of incandescent lights in preference to electric lighting. The members always looked upon Harrogate as one of the leading and most progressive gas undertakings they had.

The vote was put by Mr. A. Clement Hovey, of North Shields (the Vice-President), and carried with applause.

The President acknowledged the compliment.

Mr. J. C. Angus (York) then read the following paper:—

THE COMPARATIVE DEVELOPMENT OF GAS AND ELECTRICITY AS ILLUMINANTS.

The comparatively recent development of electric lamps of greatly increased efficiency suggests, apart from the interest which attaches to the competition between gas and electricity, certain tendencies in the development of illumination which, though frequently commented upon by members of the lighting profession, deserve perhaps a wider appreciation. Lest the title of this paper mislead you, I must say at once that it does not deal with the historical development of the two illuminants. Its object is merely to present to you within brief limits a critical comparison of the present-day development of gas and electric lighting from the standpoint of these tendencies which you have probably already remarked.

The competitive development of lighting has steadily educated the public to a higher standard of artificial illumination in public no less than in domestic lighting. This standard is the outcome of steady development of efficiency in the illuminants themselves, as well as in the methods of application. Although the demand for increased illumination is a perfectly rational one within certain limits, there is unfortunately a widespread misconception that brilliant lights of high candle power represent the attainment of good lighting, when a little closer appreciation of certain natural laws would suggest an evenly distributed illumination, and lights of comparatively low brilliance as the *desideratum*. In this respect, it is surprising how relatively small an amount of consideration is given at the present time to the problem of artificial illumination, notwithstanding the enormous sums which are annually spent in lighting by our large corporate bodies and public institutions, and, in the aggregate, in the domestic lighting of this country. The misapplication of artificial light is everywhere apparent; and misapplication represents actual waste.

Probably the chief abuse of illumination arises from its use for advertising purposes. Cost scarcely applies in this case; but in a wild endeavour to "go one better," the gas-lamp simulates the electric arc, while the blatant intensity of the flaming arc, hung a few feet above the public way, makes our busier thoroughfares a torture by night, as each shopkeeper madly tries to outshine his neighbour. The effect of this is incalculably bad, æsthetically as well as physiologically; and it is reassuring to note that the City of London Council are taking steps to mitigate this outrage

on the eyesight of pedestrians by defining the size of lamps to be used, and providing that high-power lights shall be so screened that the light shall not fall on the public way. It is to be hoped that this example will be widely followed in the interests of public welfare.

If we consider the modern development of illumination, we find that it has taken place chiefly in the direction of increase in intrinsic brightness or intensity of light per square inch of light yielding surface. This development is fostered by keen competition among manufacturers, no less than by a section of the purchasing public, who, conceiving that brilliant light must be better light, make no attempt to modify its bare intensity in adapting it to their requirements. The greatest candle power for the least cost has become an aim without any consideration for the physiological factor which governs it; a smaller candle power for the same cost, but with a better illuminating effect, being much more difficult to understand. Indeed, the full significance of this development is very imperfectly realized at the present moment, because brilliant artificial light sources are so comparatively recent that the effects upon eyesight are not clearly appreciated. Of one thing there can be little doubt, however—namely, that the continued strain and fatigue to which the eye is subjected when workir with unshaded lights of great brilliance, will in time produce results on eyesight which are fraught with serious possibilities; and it is significant to note that eye troubles are becoming more prevalent, while the use of glasses increases among the younger generation.

Technically, what does increased luminous intensity represent, and what in this respect are the relative positions which gas and electricity occupy in regard to each other? This will be best explained by first defining certain fundamental principles which govern the correct application of artificial illumination. The even distribution of light is the underlying principle in most schemes of illumination. This is essentially so in general schemes of interior lighting, where probably, in addition to an even diffusion, some local increase of light may be necessary to meet exigencies of work or other requirements, and also holds true for the lighting of large covered spaces. To attain this end, endeavour should be made to follow as far as possible the distribution and characteristics of daylight illumination—namely, downward and oblique direction, steadiness of the light, and broad diffusion, in order to avoid sharp and deep shadows. Not, however, seeking to entirely eliminate shadows, as these, by forming contrasts, are helpful, and materially assist the eye in its judgment of the form of objects. Evenness of distribution applies in some degree to street lighting; but from the nature of the case this becomes more a question of graduated distribution. Light must also necessarily strike the eye at flatter angles owing to the sources of light being low compared with the distances illuminated.

Again, in applying artificial illumination, it is important to remember that it is not so much the intensity of light which illuminates an object in the field of vision, but the amount of light which enters the eye from the object viewed, which is of importance. The eye, as we know, is able to accommodate itself to a very considerable range in intensity, owing to the contraction and dilation of the pupil; so that if a light of great brilliance is placed directly in the field of vision, the eye protects itself by contracting the pupil, and consequently receives less light. If, however, the same light is removed from the direct vision by shading, though there may result a considerable loss in the physical efficiency of the light, and a corresponding less amount of light on the object, yet the eye, working at a better aperture, is actually receiving more light from the object illuminated. Therefore, to obtain visual efficiency, lights of great brilliance are inadmissible in the field of vision. In other words, the intrinsic brightness of the luminous source must be reduced by artificial means so as to fall within such limits as the eye can accommodate without undue retinal fatigue. With lights of great brilliance, contraction of the pupillary aperture decreases the visual usefulness of the eye, so that the actual efficiency of the light source, as measured by candle-power value, is very largely discounted.

Now, in the direct field of vision, it may be fairly easily proved by experimental observation that an intrinsic brilliance of from 1½ to 2 candle power per square inch is a safe working intensity for a light-source which it is wise not to exceed, though where the general distribution of light is high these figures may be slightly increased. One authority* states that "it is a safe working rule to keep the intrinsic brilliancy of all radiants within the field of vision below 5-candle power per square inch, preferably down to half that value." Obviously, this means that some method of diffusing the light, either by means of shades or globes, should be adopted wherever the radiant is directly in the field of vision, so that the diffusing surface may be within the limits of a comfortable working intensity. Or, indirect lighting by diffusion may be resorted to by placing the lighting source out of direct vision, and securing illumination by reflection.

Apart, therefore, from the injurious effect which it may have upon the eye, we are forced to conclude that great intrinsic brilliancy is undesirable in an illuminant, owing to the considerable loss in efficiency which its correct treatment requires. Let us see how gas and electricity compare in this respect.

The strong position of gas as an illuminant to-day is due entirely to the invention of the incandescent mantle, which has so enormously increased its illuminating efficiency. The improvements in mantle production during recent years have been steadily progressive. The colour of the light emitted is now almost white or yellowish white of considerable penetrative power; the loss in candle efficiency is comparatively small, even after 1000 hours' burning; while the mantle itself is less fragile, though still far from perfect in this respect. The intensity of the light emitted by the incandescent mantle is dependent upon flame temperature. When used with the ordinary Welsbach low-pressure burner, the intrinsic brilliance per square inch, on the assumption of uniform intensity over the whole surface, varies from about 15 to 25 candle power. With burners working at high pressure, the intensity is considerably higher, and varies from 30 to 50 candle power. The total range of intensity of the incandescent mantle is therefore between 15 and 50 candles per square inch of luminous surface.

While the development of gas lighting has confined itself entirely to the incandescent mantle and bunsen burner in variously adapted forms, electric lighting has evolved four distinct commercial types of lamp—the electric arc, the glower, the incandescent filament, and the incandescent vapour.

The electric arc lamp is the most intense source of light of any artificial illuminant. The passage of the electric current between the carbons causes intense heat, in which the carbon is volatilized, and a brilliant light is produced. The actual intensity of the arc crater is difficult to arrive at with any degree of certainty; but it is probably in the neighbourhood of 50,000-candle power per square inch. When fitted with an opalescent globe, the intensity of the bright patch varies from 400 to 700 candle power per square inch. The so-called enclosed arc consists of an inner globe, generally of elongated pattern, through which the carbons pass with the smallest amount of clearance, and thus burn almost excluded from air. Under these conditions, a longer arc is possible, and the intense luminous crater, distinctive of the open arc, almost disappears. The carbons burn at a slower rate, and the light is much steadier than the open arc; but there is considerable loss in luminous efficiency, which is more or less compensated for by reduced maintenance. The intensity per square inch varies, according to the density of the opalescent inner globe, from 100 to 150 candle power. The flaming or luminous arc produced by the impregnation of the carbons with metallic salts is the latest development of the arc lamp; its light being derived from the luminous gases thus introduced into the arc flame. The efficiency of the luminous arc is very much greater than the ordinary open arc, and its diffusion of light is excellent. When fitted with a dense opalescent globe, the intrinsic brilliance is approximately that of the open type; but being a light of great candle power, it is only suitable for positions where it can be placed at a considerable elevation.

The glower type, represented by the Nernst lamp, consists of a highly refractory filament rendered highly incandescent by the passage of the electric current. The intensity, with a clear globe, varies from 800 to 1000 candle power per square inch.

The incandescent filament lamp is, however, the mainstay of electric lighting. In this lamp, a filament of high resistance, enclosed in a globe or bulb from which the air is exhausted, is brought to a high degree of incandescence by the passage of the electric current. The filament consists of a slender thread of carbon; but within the past few months lamps with filaments of the rarer metals—tantalum, tungsten, and osmium—as well as metalized carbon filaments, have been placed upon the market, from which very much higher candle-power efficiencies are obtainable. So far, these metal filament lamps are only suitable for low electrical pressures, excepting in the higher candle-power lamps. The ordinary carbon filament lamp, with clear globe, has an intrinsic brilliance of from 180 to 300 candle power per square inch; while the metallic filaments range from 500 to 800 candle power per square inch.

If we now tabulate the relative intensities, it is apparent that incandescent gas is very low in the scale of intrinsic brilliance compared with the electric lamp. It is specially noticeable that the electric filament lamp in common use is at least eight times more brilliant than the low-pressure incandescent gas mantle, and that the higher efficiency metallic filament lamps have over thirty times greater brilliance. As the great majority of filament lamps are supplied in clear globes—generally insufficiently shaded by reflectors of shallow depth, and are used more often than not within comparatively short range of the eye—too great regard cannot be given to the serious menace to eyesight which this implies, owing to the image of the glowing filament falling on the less-used portions of the retina. The filament lamp is more insidious in this respect, because of its low candle power, and the natural desire to bring it close to the work in hand.

Description of Light.	Approximate Intensity in Candles per Square Inch of Light Source.
Electric arc (open type)	400 — 700 (*a*)
,, (flaming or luminous)	500 — 700 (*a*)
,, (enclosed type)	100 — 200 (*b*)
Nernst glower	800 — 1000 (*c*)
Electric incandescent (carbon filament)	180 — 300 (*c*)
,, ,, (metal filament)	500 — 800 (*c*)
Incandescent gas mantle (low pressure)	15 — 25 (*c*)
,, ,, ,, (high pressure)	30 — 50 (*c*)

(*a*) Depending on opalescence of globe.
(*b*) Depending on opalescence of inner globe.
(*c*) Fitted with clear globes.

* Dr. Louis Bell—"Art of Illumination."

The logical inference would therefore be that, given the same candle power—for quantity of light as well as an intrinsic brilliance must be considered in this respect—the incandescent gas mantle is physiologically superior to such intense radiant light-sources as the electric arc and incandescent filament lamps. In order to balance the physiological factor, means for diffusing the light and reducing its intrinsic brilliance must be employed—such as translucent globes—or the source of light entirely screened and reflective surfaces utilized. But by so doing, it is apparent that the efficiency factor is so reduced as to be much in favour of incandescent gas.

There is considerable difficulty, however, in determining this factor or in making any absolute comparison of the loss in efficiency by direct shading with semi-translucent globes, owing to the diffusion becoming less uniform as the intrinsic brightness of the light source increases. A standard of 5-candle power per square inch may be fairly approximately obtained on a diffusing surface with a radiant of comparatively low intensity like the incandescent gas mantle; but with an arc lamp, a patch of intense brightness meets the eye from any point of direct view, even when employing opalescent globes giving a total loss in physical efficiency of 50 to 60 per cent.

Apart from many considerations—such as cost, maintenance, colour value, and local conditions, which variously affect a scheme of illumination—it may be generally accepted that the intelligent employment of lights of moderate candle power gives the most satisfactory results. By multiplying the number of units and reducing the intensity of the light-source, a more even distribution is secured, free from the patchy effect produced by the concentration of lights in units of high illuminating power; and it would seem that, from the standpoint of efficiency, these general conditions are more favourable to gas than to its competitor electricity. It is natural in many ways that gas engineers should strive to emulate the electric arc by producing burners of high power; but it should not be forgotten that the brilliance of the arc is its chief defect, and high power somewhat unavoidable, owing to the limitations of size to be observed in securing reasonable maintenance with efficiency in the arc lamp.

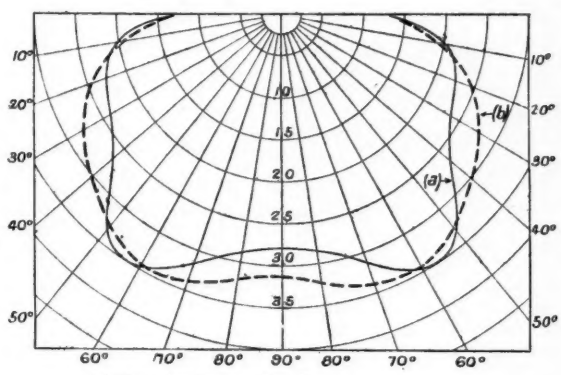
The question of comparative cost opens up a wide field of discussion; for, though cost generally resolves itself into a comparison of candle power produced for a given sum, nearly every lighting scheme is more or less governed by factors which must be closely considered before a definite comparison can be made. For this reason, only concrete examples are of any value; and the short limits of this paper scarcely admit of their proper investigation. I should like, however, to make a passing comparison of cost between incandescent gas and the metallic filament lamp, chiefly because it is of interest as indicating the great vitality of the gas industry.

One of the first lamps of this description to be commercially successful was the tantalum filament lamp. Its use has, however, been somewhat limited, owing to its unsuitability for alternating current and its low working voltage—about half the usual town electrical pressures, which necessitates running two lamps in series. The average efficiency is about 2½ watts per candle, a distinct advance on the 3·5 to 4 watts of older carbon filament lamps. Recently several metallic filament lamps have made their appearance, the most efficient of which appears to be one in which the filament is composed of zirconia and tungsten. The efficiency of this lamp (32-candle power) is about 1·1 to 1·25 watts per candle; and its chief advantage its suitability for direct or alternating current at ordinary pressures of 200 to 220 volts.

At the present time, the metallic filament lamp is somewhat delicate owing to the extreme fineness, as well as softness, of the filament when incandescent. It possesses, however, the peculiar property of sometimes repairing itself when snapped or broken. If the broken end of the filament becomes crossed with another portion of the filament, so that the circuit is completed, the lamp lights up again. The tantalum filament appears to possess this property to a greater degree than other metallic filament lamps. The chief interest, however, lies in the fact that the metallic filament lamps are from two to three times as efficient as the older carbon lamps, and that it is only a question of time before they will be so perfected as to almost entirely supersede the less efficient carbon filament, excepting, perhaps, in lamps of small candle power. For at the present time it does not seem likely that a lamp can be manufactured to be commercially successful on ordinary voltages of 200 to 230 with a less candle power than 25 to 30, owing to the extreme fineness and delicacy of filament required in lamps of low candle power at high voltage.

This matter of candle power is an interesting point, and is particularly worthy of attention, because, while the electric engineer aims at securing a lamp of about 25 candles, the gas engineer is already in a peculiarly happy position to compete. For many purposes there is a great demand for a smaller standard burner than the ordinary "C" Welsbach; and this already exists in the small inverted burner consuming slightly under 1¼ cubic feet of gas per hour.

The candle power of one of these lamps is given in the diagram, which shows curves of candle power distribution for both the miniature inverted burner and tantalum lamp superimposed. There is evidently little to choose, so far as actual candle power and light distribution are concerned; but as regards comparative cost, with gas at (say) 3s. per 1000 cubic feet the cost of electricity to compare should be approximately 1d. per B.O.T. unit. This represents the bare cost of gas and electric current—a comparison



(*a*) Tantalum lamp with reflector.
(*b*) Small inverted burner with globe and reflector.

Curve of Candle-Power Distribution.

which is rather misleading. If we, therefore, assume a useful life of 700 burning hours for both the gas mantle and tantalum lamp, and add the renewal costs of these to the costs of gas and electricity, we obtain the following:—

	Cost for 700 Hours Burning.
Cost of gas (3s. per 1000 cubic feet) 31½d. + mantle renewal 4½d.	= 36d.
Cost of electricity (1d. per B.O.T. unit) 31½d. + lamp renewal 33d.	= 64½
Balance in favour of gas	28½d.

Which suggests that, having purchased tantalum lamps at their current market price, one must obtain current at a cost of under one tenth of a penny per B.O.T. unit to equal gas at 3s. per 1000 cubic feet.

It would seem that the possibilities of the small inverted burner are scarcely appreciated by gas engineers at the present moment. This is largely due to the many indifferent burners of this class on the market, which, displaying entire lack of consideration in their detail, give very irregular results. During the past two years the small inverted burner has interested me considerably, chiefly in connection with its adaptation to railway carriage lighting. The astonishing result of these trials has been the remarkable life of the mantles, notwithstanding the incessant jar to which they are subjected. The net results of experiments have proved that absolute rigidity of the mantle-supporting ring is essential, and that uniformity of size is to be observed, so that the bunsen flame is perfectly enveloped by the mantle. Under these conditions, the life of the mantle is about 800 burning hours, irrespective of the actual running hours of the vehicle, when the mantles are, of course, subjected to the ordinary vibration incidental to rolling stock.

This excellent performance suggested their trial for station lighting purposes; and here, too, the life has been exceptionally good, the mantles in use having averaged 1500 hours. The effect of the small inverted mantle is particularly good when grouped in clusters of three; and with a special lantern arranged in this manner an illumination of 93 candles at 5° below the horizontal has been obtained with a consumption of 3·65 cubic feet of gas. Rigidity of mantle-support and selection of a reliable mantle of uniform size are the chief points to be observed.

In conclusion, I should like to refer to the mercury vapour arc lamp, and the "Moore" vacuum light. The remarks I have made on intrinsic brightness would be incomplete without reference to these, for both are developments in that field of illumination in which low intrinsic brilliance is aimed at. The essential principle is the same in both—namely, the passage of an electric current through a rarefied gas. The mercury vapour lamp, though highly efficient as a light producer, is objectionable on account of its colour, for which reason its use will necessarily be restricted. The intrinsic brightness is approximately 3 to 6 candle power per square inch. The "Moore" light, while free from the objection of colour, is a light source of high efficiency, with an intrinsic brightness so low as ¼ to 1½ candle power per square inch. From the nature of its installation, its field of application would appear to be somewhat limited; and, so far, I know of only one or two installations in this country.

Discussion.

Mr. W. Doig Gibb (Newcastle-on-Tyne), the President of the Institution of Gas Engineers, in opening the discussion, said it was seldom if ever that he had read a paper in which the substance before them was set out in a better or more finished style of composition. There was just one point to his mind that required clearing up—that was the absolute want of any standard of candle power when the light emitted from an electric light was talked about. There must surely be something wrong somewhere, because they as gas men had a specified way of testing their candle power. They knew exactly what an incandescent gas-light in the street was giving. But when they were told that such-and-such an electric light had 1800-candle power or 2000-candle power as the case might be, if they applied any test so as to compare the

lighting power of a gas-lamp and an electric arc lamp the figures did not any way fit. They knew exactly by testing the candle power of their gas-lamps; but with respect to the arc lamps the light was nothing like what it was claimed to be. The paper just read to them had a peculiar value, inasmuch as it came from a gentleman who had charge of both the electric and the gas lighting of one of the most important Railway Companies in the country. It should therefore be very useful to the members when making comparisons.

Mr. A. C. HOVEY (North Shields) remarked that the paper had showed most clearly the development which had taken place with regard to electric lamps. There was one point which should be taken notice of; and that was the extending use of the incandescent gas-mantle for railway carriage lighting. Mr. Angus, referring to the delicate arrangements of some of the electric filament lamps, pointed out that it was very necessary to employ with them some anti-vibration device, whereas this was not now regarded as at all needful with the small incandescent gas-mantles used for railway carriage lighting.

Mr. J. H. HILL (York), referring to the comparative price of gas and electricity, said that compared with the basis of 2s. 2d. (the price at York) they would require electricity to be absolutely given to them, together with 5¾d. towards the cost of the Tantalum lamp, in order to bring the price equal. He considered there was a great amount of leeway to make up with the latest lamps.

The PRESIDENT also complimented Mr. Angus on his paper, and remarked that the consumer could now sit down with the particulars before him and calculate exactly how deeply he would have to put his hand into his pocket if he wished to recoup himself for the difference in the cost between the two lights.

Mr. ANGUS, in reply, said it was rather difficult to say all one wanted to say in such a short paper; and the subject was a difficult one to treat in so limited a time. He had to leave out much which would otherwise be of interest. He explained that in drawing his comparisons of the cost of the Tantalum lamp he had taken present prices; but there was no doubt they would come down in price before long. There were, however, immense possibilities in the small inverted burners now so extensively used; and he remarked that it might be interesting for the members to know that he could successfully light a room 22 feet by 11 feet with one bijou burner fixed at a height of about 8 feet from the floor—of course, using suitable glassware and reflectors.

On the motion of Mr. C. DRU DRURY (Sunderland), seconded by Mr. G. SAYNER (Harrogate), and supported by the PRESIDENT, Mr. Angus was thanked for his paper.

The members then went by motor char-a-banc on an interesting tour.

The members were subsequently entertained to an excellent luncheon at the George Hotel, by the Directors of the Harrogate Gas Company the Chairman of the Company (Mr. F. Barber) presiding.

After the usual loyal toasts,

Mr. A. C. HOVEY submitted the toast of the "Harrogate Gas Company." He remarked, in the course of some interesting particulars as to the Company's career, that the average service of the Secretary (Mr. Wilkinson), the Engineer (Mr. Sayner), and two foremen, Mr. George Drighton and Mr. William Drighton, was 38½ years.

Mr. BARBER responded, and remarked that the Board of the Company considered that for their General Manager to be appointed President of such an Association as this was certainly a great compliment, and Mr. Wilkinson had thoroughly well deserved the honour, for he knew of no man who had been more assiduous in his duties or more anxious for the welfare of the Company than he was.

Mr. E. W. DIXON proposed the toast of the "North of England Gas Managers' Association."

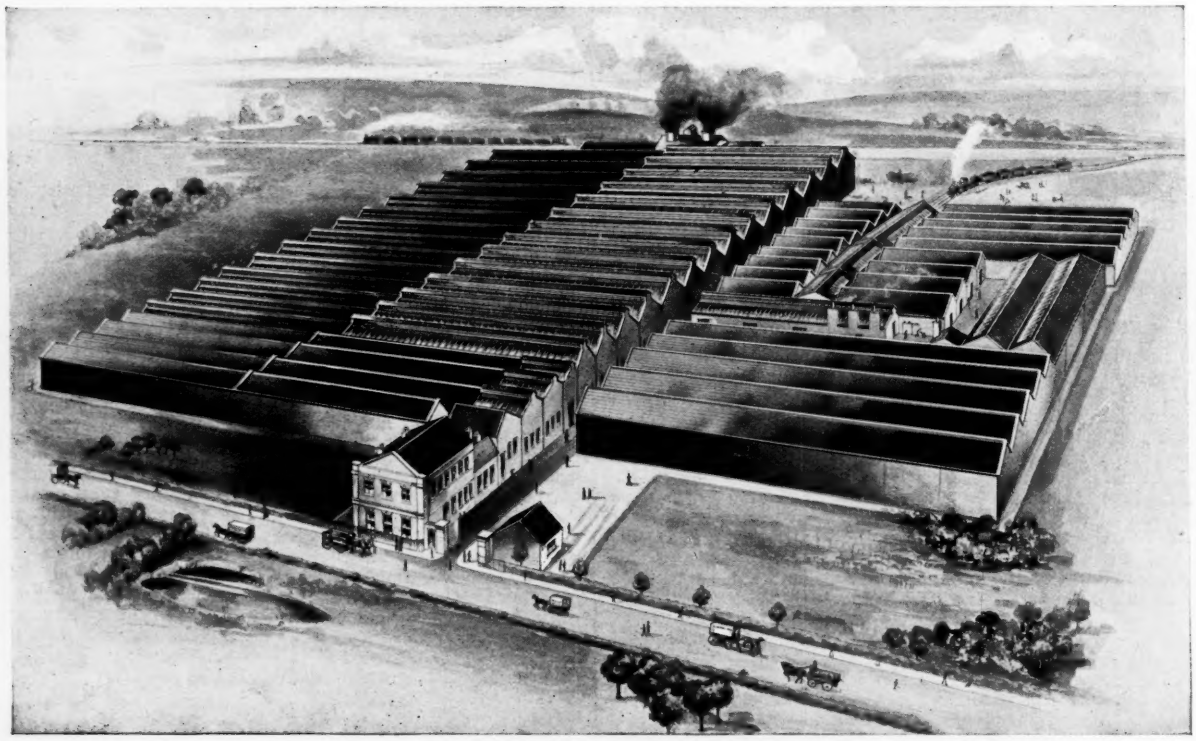
Mr. WILKINSON, in response, remarked that the Association was in the 30th year of its existence, and it was a pleasure to know that they still had with them a number of the founders.

Mr. THOMAS BOWER (West Hartlepool) proposed "Kindred Gas Associations."

Mr. W. DOIG GIBB said he was pleased to know that during his presidency of the Institution of Gas Engineers the North British Association had become affiliated with them; and thus, for the first time in their history, they were one united body without a rival. The Council of the Institution had drafted a complete Gas-Works Clauses Act which they hoped Parliament would replace for the now obsolete Gas-Works Clauses Act, which had been in force since 1871. They hoped next session to carry the clauses, which would, he felt sure, give greater satisfaction to the gas industry.

The proceedings shortly afterwards closed.

THE DAVIS GAS-STOVE COMPANY'S NEW WORKS AT LUTON.



IN the "JOURNAL" for the 16th of April last we gave an account of the new works—the "Diamond Foundry"—at Luton of the Davis Gas-Stove Company, Limited, of London and Manchester, on the occasion of the visit of the members of the London and Southern District Junior Gas Association. We now give a view of the works, which occupy a site 15 acres in extent. The buildings at present roofed in cover considerably more than half this area. These are claimed to be the largest gas-stove works in the United Kingdom; and they are owned by one of the largest and oldest firms of gas-stove manufacturers.

Institution of Mechanical Engineers.—We learn from the Secretary (Mr. Edward Worthington) that the first monthly general meeting for the coming session will be held in the Institution House, Storey's Gate, S.W., on the 18th inst., when a paper will be read by Professor Bertram Hopkinson, of Cambridge, on "The Indicated Power and Mechanical Efficiency of Gas-Engines."

THE "COALITE" SPECIFICATIONS.

Many of our readers have, no doubt, been awaiting with a considerable amount of interest the publication of the specification of the patent taken out by Mr. Thomas Parker for the production of the fuel which has lately come so prominently before the public under the name of "Coalite," and which the British Coalite Company, Limited, has been formed to place upon the market. The complete specification, which was deposited on the 24th of December last and accepted on the 21st ult., will not be on sale till the 17th inst.; but we are able, from the copy which is open to inspection at the Patent Office, to make readers acquainted with the contents. The following are the principal portions of the document.

This invention relates to the production of fuel by the partial destructive distillation of coal at low temperature, whereby a fuel is produced of uniform composition and of high calorific value, whose combustion in an open fire-grate yields a high temperature, and is practically smokeless, and whereby also, in the process of its production, gas, tar, and ammonia are yielded, so that thus the cost of production of the fuel is such as to allow of its ready sale on the market.

I am aware that it has before been proposed to produce, by a process of partial destructive distillation, fuel resembling coke, and to secure thereby a considerable yield of tar as well as an illuminating gas of high candle-power; but it has not heretofore been practicable to produce by a simple process of destructive distillation, without some preliminary or after treatment, such a fuel of substantially constant and uniform character, which, while being capable of practically smokeless combustion at a high temperature in an ordinary fire-grate, and being readily ignitable, is of sufficient hardness to stand handling, stacking, and carriage.

After very careful research, I have determined the conditions under which such a fuel of substantially constant and uniform character can be produced by the use of the various kinds of coal commonly classed as bituminous coal. I have found, on the one hand, that if the temperature of distillation be excessive, the product is difficult to ignite and keep burning in an ordinary fire-grate, and varies very much in character and quality, owing to the difficulty of arresting the process at the particular point short of complete carbonization beyond which it is difficult to retain in the fuel heated sufficient hydrogen to ensure its combustion at a high temperature; while, on the other hand, if the temperature of distillation be too low, the product is soft and friable, and the duration of the process is considerable and not easy to determine —rendering it very difficult to produce, in a practical and commercial way, a fuel of uniform character and homogeneity that is sufficiently hard to withstand handling, stacking, and carriage, or that will not require further treatment to render it fit for commercial use.

Now, according to this invention, I effect the destructive distillation of bituminous coal within a closed retort; and I maintain the temperature within the retort at about 800° Fahr. during the process of distillation. The duration of the process of distillation may readily be determined at the point when illuminating gas ceases to be given off, and when the evolution of hydrogen and non-luminous gas is shown by the characteristic colour of the flame, which may be ascertained by means of a jet provided for the purpose, through which the gas is emitted. I have found that when the process of distillation is conducted at about 800° Fahr., as indicated within the retort, and the process arrested as described, the fuel produced has high hydrogen contents, and sufficient hardness to withstand handling, stacking, and carriage.

In order to obtain the best results, the coal must be so arranged, as regards the source of heat, that the whole mass of the coal being treated can be evenly and uniformly heated; as, otherwise, if the coal is heated in large and thick masses, the character of the outer layers will be destroyed by the time the inside of the mass has been sufficiently heated.

With ordinary bituminous coal—that is, with coal which does not melt or run when heated—I have obtained very good results by the use of a ⌂-shaped metal retort 16 inches high, 5 feet wide, and 7 feet long, placed horizontally; and by charging the fuel into the retort to a height not exceeding 6 inches, the heating will in such cases generally last about six hours, but the flame test will decide the exact time of treatment.

In the case of very bituminous coals—viz., those coals in which under heat the coal melts or runs—it is best, instead of placing the coal in large vessels in thin layers, to arrange the coal in slightly tapering closed cylinders about 10 to 12 inches in diameter, and to fill these cylinders with coal. One end of each cylinder is perforated, to allow the escape of the gases; and several of such cylinders may be heated within a retort such as above described. With very bituminous coal, the structure of the fuel produced is harder and denser when the cylinders are filled than if free room for expansion is allowed.

Instead of placing the cylinders horizontally in a retort, the coal may be destructively distilled in vertical retorts, which will ensure fuel of good structure from all kinds of bituminous coal. When effecting the distillation in such vertical retorts or furnaces, the cross sectional dimensions of the retort should not be less than 6 inches, and preferably the retort should be so set as to be heated all round. The best results with all classes of bituminous coal are obtained when the distillation is carried on in closed cylinders completely filled, or within vertical retorts or furnaces as above described.

I lead away the gases evolved, and pass them through a condenser, scrubber, and purifier, and otherwise deal therewith substantially in the same manner as is usual in the ordinary method of manufacture of coal gas. Towards the end of the process, I admit steam into the retort, to ensure the final temperature being slightly lowered, and to cleanse the fuel from sulphur; and I draw the fuel from the retort immediately on illuminating gas ceasing to be evolved. I quench the fuel either before or after being drawn from the retort; but I prefer first to draw the fuel into a receptacle where it is no longer subjected to heat, and after its closure I then quench the fuel by admission of steam, so that the fuel may not re-ignite. A hard fuel results, capable of use without any further treatment, and which in burning in an open grate develops more heat than ordinary coal, lasts longer in burning, and is, moreover, practically smokeless in combustion.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is—

1.—An improved hard and smokeless fuel prepared from bituminous coal by a process of partial destructive distillation carried on substantially as hereinbefore described.

2.—A process for the preparation of a hard and smokeless fuel from bituminous coal, consisting in subjecting the coal to partial destructive distillation, so that the whole mass of the coal is maintained at the temperature of about 800° Fahr. until the illuminating gases cease to be evolved, and then stopping the distillation and quenching the fuel, substantially as described.

3.—A process for the preparation of a hard and smokeless fuel as described in claim 2, and in which, prior to quenching the fuel, it is treated with steam substantially as and for the purpose described.

The specification of the American patent, which was filed on Jan. 26, 1907, and has been published in the United States Patent Journal, concludes with the following claims:—

1.—The herein described process for the production of fuel from coal which consists in subjecting the coal in a closed retort to a comparatively low gas-evolving temperature, maintaining it at this temperature while illuminating gas continues to be evolved, and cooling when illuminating gas ceases to be evolved and when the mass is substantially free of tarry components, so that the product shall be hard, of uniform character, homogeneous, and capable of withstanding stacking, handling, and carriage without further treatment.

2.—The herein described process for the production of fuel from coal which consists in subjecting the coal in a closed retort to a temperature of about 800° Fahr., maintaining it at about this temperature while illuminating gas continues to be evolved, and then cooling and removing the fuel from the retort.

3.—The herein described process for the production of fuel from coal which consists in subjecting it in a closed retort, under moderate pressure, to a temperature of about 800° Fahr., maintaining it at this temperature while illuminating gas continues to be evolved, and cooling and withdrawing the fuel when illuminating gas ceases to be evolved.

4.—The herein described process for the production of fuel from coal which consists in subjecting the coal in a closed retort to a temperature of about 800° Fahr., maintaining it at about this temperature while illuminating gas continues to be evolved, and then suddenly arresting the heat by the introduction of steam, and removing the fuel from the retort.

Midland Association of Gas Managers.—We learn from the Hon. Secretary (Mr. Charles Meiklejohn, of Rugby) that the autumn meeting of the Association will be held in the Grand Hotel, Birmingham, on the 17th inst. Fuller particulars will be announced later.

Proposed Heating and Lighting Exhibition in St. Petersburg.—We learn from documents received from the Imperial Russian Financial Agency that the Imperial Russian Technical Society are organizing in St. Petersburg an International Exhibition of modern appliances for lighting and heating, in order to ascertain the present state of the production of such appliances, to disseminate information in regard to them, and to judge of their comparative merits. The exhibition will be opened on the 1/14th of December, and will continue for two months; but the time may be extended by the Managing Committee. In the Lighting Section will be included ordinary gas-lamps, incandescent lamps, mantles, cones, &c., and means for artificially intensifying and diffusing light. Other sections will comprise gas and electric heating appliances, and apparatus for preventing fires and accidents in connection with the use of gas and electricity for lighting and heating, and also for measuring these illuminants. The exhibits will be examined and tested by a Committee of Experts, some of whom will be elected by the exhibitors, and prizes will be awarded. Applications for space should be addressed to the Committee, at No. 2, Panteleimonsky Street, St. Petersburg, and exhibits (which will be carried over the Russian, German, French, Austrian, and Belgian lines at a single rate) will be received from Nov. 1 (Nov. 14) to Nov. 25 (Dec. 8).

PERSONAL.

Mr. J. Staunton, late of the Sutton Valence Gas Company, has been engaged as Manager of the works of the Robertsbridge, Salehurst, and Hurst Green Water and Gas Company.

Mr. F. Scholefield, who, it may be remembered, was one of the promoters and the first Hon. Secretary of the Yorkshire Junior Gas Association, has been appointed Assistant-Manager of the Dewsbury Corporation Gas-Works.

The Shipley Urban District Council have appointed Mr. Henry Tavernor Assistant-Manager of their gas-works. Mr. Tavernor went to Shipley from Macclesfield in 1897 as works foreman. In 1900 he became Superintendent of the works; and, at the suggestion of the Manager (Mr. Wilcock) he has now been raised to a higher position. During the past ten years he has superintended the remodelling of the works. A new retort-house has been erected, inclined retorts have been introduced, and new purifiers put in.

OBITUARY.

The death occurred last Thursday afternoon, in his 75th year, of Mr. Patrick Riordan, the Manager of the Limerick Corporation Gas-Works. Deceased was a well-known local politician, and a strong supporter of Mr. Parnell. He was for many years a member of the Corporation, was an Alderman, and held the office of Mayor in 1891. His election, some ten years ago, to the position he filled at the time of his death, was generally regarded as a tribute by his colleagues to his probity and uprightness of character.

We regret to record the death, on the 28th ult., in his 56th year, of Mr. John Pinchbeck, whose name is well known to gas managers in connection with his prepayment and other meters. He was apparently in his usual health on the previous day, but was taken ill in the night, and died quite suddenly. The business of which the deceased was the head was started in 1844 by his father, Mr. James Pinchbeck; and it will now be carried on, on behalf of the widow, by Mr. J. Harling, who has been connected with the firm for some years. Deceased was a Freemason, and his funeral last Wednesday, at St. Pancras Cemetery, was attended by representatives of the Craft as well as of the gas industry.

Many of our readers will, we are sure, learn with regret of the sudden death, last Saturday, of Mr. Basil Pym Ellis, son-in-law of Sir John Aird, Bart., and a member of the great engineering firm of which Sir John is the head. The sad event occurred in the Paris office of Messrs. Thomas Cook and Son, in the Avenue de l'Opéra. Mr. Ellis had gone over to Paris with his wife and daughter, and, in honour of Miss Ellis's birthday, all three were to have gone to the Opera on Saturday night. He went into Messrs. Cook's to change some notes, and was standing at the cashier's counter when he fell to the floor. The office was full of people, among whom was a French doctor, who had Mr. Ellis carried upstairs to the reading-room. Dr. Petrovitch was also summoned; but Mr. Ellis had died before his arrival. Deceased, who was 57 years of age, was personally known to a large number of our readers, in connection with the carrying out of contracts by his firm; and he directed much of the work on the gigantic dam at Assouan. He was a Freemason, and a member of the Evening Star Lodge.

AMERICAN VIEWS OF MUNICIPAL OWNERSHIP.

In previous issues of the "Journal," reference has been made to the investigation into the subject of municipal trading carried out by the Committee on Public Ownership and Operation of the American National Civic Federation, and to the two reports made by them thereon. The majority report was signed by each member of the Committee present at the meeting at which it was adopted, with the exception of Mr. Walton Clark, the President of the Franklin Institute of Pennsylvania and Vice-President of the United Gas Improvement Company of Philadelphia, who declined to sign it, and presented a minority report. The complete record of the Committee's work has not yet been published; but we have received prints of the two reports above referred to, and the principal features are given in the following abstract.

A thorough understanding of the majority report requires more than casual reading. In statement and suggestion it consists mainly of recommendations of various details of a system of control of public service corporations, and of warnings against the difficulties and dangers attending municipal ownership, which it does not, in set terms, condemn or commend. Probably the public would have been better pleased to have received definite recommendations as to the wisdom of American cities adopting municipal ownership. In the light of what is revealed in the record of the investigation, such definite recommendations could not reasonably be expected from a body, many of whose members were previously committed to the municipalization theory by their extensive writings. From men who have given their names to such books as some of these Committeemen have fathered, with arguments to show the economic soundness of the municipalization programme, and confident citations of happy results from municipalized industries, an unqualified condemnation of municipal ownership was not to be expected, It is most creditable to these writers that they so far have been able to divest their minds of prejudice as to recognize the significance of the facts developed by the Committee's investigation, and to record this recognition by signing a report containing no claim that municipal ownership has anywhere been successful, and no prophecy that, under any existing or creatable conditions, it ever will be successful. The following paragraphs are the product of an effort to properly analyze the majority report.

The opening paragraphs of the report contain a statement of the procedure of the Committee, thanks to the people in charge of the public utilities investigated, and reasons for the failure to give a positive answer to the question at issue. The first statement bearing directly on the main question is to the effect that municipal electric plants have had "a struggle to exist in the face of unsympathetic public opinion." Evidently the municipalizers have been misleading us in their assertions that municipalized industries in America, and more particularly in Great Britain, were in high favour in the communities in which they were operated. The statement that these municipal plants have had to struggle for continued existence because of an unsympathetic public opinion, appears to condemn municipal ownership, if condemnation may come from those most immediately affected by municipalization—citizens of towns where it has been tried.

The report next suggests that we must not judge between the effects of municipal and company operation in Great Britain without taking into consideration the fact that the companies are unnecessarily handicapped by the short terms of the franchises granted to them; the municipalities having necessarily the advantage of perpetual rights. The report also calls upon us to make allowance for differences in social and political conditions, when arguing from the results of municipalization in Great Britain to what may be expected in America. The exact language of this part of the report is as follows: "In other words, a measure of success in the municipal management of public utilities in England should not be regarded as necessarily indicating that the municipal management of the same utilities in this country [America] would be followed by a like measure of success." The report condemns competition in the supply of public service, and states that the question is whether it is better for the public to operate or to regulate public service industries as monopolies.

The report records the opinion of the majority, that undertakings in which the "sanitary motive largely enters"—meaning water-works and sewers—should, as concerning the health of the citizens, be operated by the public. A careful reading of what has been printed by the Committee in regard to their investigations into the water-works of the United States leads inevitably to the conclusion that this opinion of the majority is the expression of their belief that water supply has to do with the police powers of the municipality, and therefore should not be left to private enterprise, or be regarded as a legitimate field for money-making ventures.

The report, which up to this point contains no approval of municipal ownership of any industry except water supply, next classifies certain services that should not, in any event, be undertaken by a city, and states that no municipal ownership should be undertaken solely for profit. It next recommends that municipalities should be given the right to enter into municipal ownership "upon popular vote under reasonable regulation." It recommends that municipalities should be given this right in order that the public may be put in a position to trade with companies seeking franchises; and it contains the further statement that the provision it thus recommends will tend to prevent municipal ownership. Then, after recommending regulation and profit-sharing, the report takes up the difficulties of municipal ownership, and sets forth certain conditions as essential to success—conditions recognized by the Committee as not generally existing, and as difficult to secure. On some of these points the following remarks are made:—

> We are of opinion that all future grants to private companies for the construction and operation of public utilities should be terminable after a certain fixed period, and that meanwhile cities should have the right to purchase the property for operation, lease, or sale, paying its fair value. To carry out these recommendations effectively, and to protect the rights of the people, we recommend that the various States should give to their municipalities the authority, upon popular vote under reasonable regulations, to build and operate public utilities, or to build and lease the same, or to take over works already constructed. In no other way can the people be put upon a fair trading basis, and obtain from the individual companies such rights as they ought to have. We believe that this provision will tend to make it to the enlightened self-interest of the public utility companies to furnish adequate service upon fair terms, and to this extent will tend to render it unnecessary for the public to take over the existing utilities or to acquire new ones. Furthermore, we recommend that provision be made for a competent public authority with power to require for all public utilities a uniform system of records and accounts, giving all financial data and all information concerning the quality of service and the cost thereof, which data shall be published and distributed to the public like other official reports; and also that no stock or bonds for public utilities shall be issued without the approval of some competent public authority. We also recommend the consideration of the "sliding-scale," which has proved successful in some cases in England with reference to gas, and has been adopted in Boston. By this plan the authorized capitalization is settled by official investigation, and a standard rate of dividend

is fixed, which may be increased only when the price of gas has been reduced. The subway contracts, and their operation in Boston and New York, are also entitled to full consideration.

The report does not contain any endorsement of municipal ownership, even under the conditions claimed to exist in Glasgow, Manchester, and Birmingham, whose local governmental conditions are particularly commended, and are stated to be "distinctly favourable to municipal ownership;" nor is there any statement that it is wise, under such favourable governmental conditions, or any claim that it has resulted in good to the citizens of these well-administered towns or elsewhere. Municipalizers, in their arguments, have not generally included better service as a result of municipal ownership. They have based their hopes on convincing their readers or hearers that profits may be made and local governments purified by the municipalization of industries. The report speaks definitely on these points, and in flat contradiction to the municipalizers' cherished arguments; for it says: "We have come to the conclusion that municipal ownership should not be undertaken solely for profit; we are unable to recommend municipal ownership as a political panacea."

The report, as a whole, bears evidence of an effort to warn the American people against municipal ownership, without using such terms as would prevent the pre-committed, but now doubting, municipalizers from signing it. It offers some compliments to British municipalities; cites reasons why such a measure of success as has been elsewhere claimed to have been attained in Great Britain may not be expected in the United States; gives warnings of difficulties and dangers accompanying municipal ownership; and deals with the importance of the regulation of public service companies. It asserts that governmental, social, and political conditions in Great Britain are favourable to the success of municipal ownership; but it makes no record or claim of such success, and there is no statement that similarly favourable conditions (which do not exist) would be likely to make for success in the United States.

That the former advocates of municipal ownership on the Committee should come from investigating the municipal ownership of gas, electric light, and street railway industries by the well-governed cities of Great Britain, and are willing to sign a report that does not state that municipal ownership of these industries anywhere offers a success to be emulated or an example to be followed, but does state that it has antagonized public opinion in cities that have tried it, appears to furnish a complete and negative answer to the question: "Should American cities adopt municipal ownership of public utilities?"

The minority report is more direct than that of the majority. It opposes all municipal trading, and advocates State regulation of public service companies. Mr. Walton Clark says that he is convinced that the condition of the British people, whether individually or collectively, has not been improved by the municipalization of the industries investigated. He quite believes that political and social conditions in the United States are less favourable to the success of municipal ownership than are the same conditions in Great Britain; and he finds this conclusion strengthened by the Committee's investigation into municipalized industries. He is convinced that, under American conditions, the system of private ownership of public utilities is best for the citizens and the consumers.

Controlling Boiler Furnaces.

In a translation from the "Zeitschrift für Chemische Apparatenkunde," the "Chemical Trade Journal" notices a paper by Herr A. Dosch on the control of the burning process in boiler-furnaces. In order to know with certainty whether the combustion is proceeding satisfactorily in all respects, it is necessary to have means for determining the draught or low pressure, which draws the air through the fuel and the combustion gases through the flues; also the temperature either in the firebox or the gas channels, or, best of all, of the gases at the end of the furnace, where the combustion is complete. Finally, it is necessary to ascertain the composition of the flue gases. As regards the first of these items, it is not sufficient to determine the pressure at one point only. What is required is the pressure at two points—such as the damper and the firebox; or the pressure at one of them, and the difference of pressure between this and some other point. In the paper, a number of ingenious appliances are described for this purpose—some provided with automatic registering apparatus. The temperature at the point where combustion is complete does not exceed 500° C., and is usually not more than half this value. Consequently it can be measured by means of a mercury thermometer, and no special pyrometers are required. For the determination of the composition of the gases, the weight of the gas gives a ready criterion, as its variations are caused almost entirely by differences in the percentage of carbon dioxide. For the determination of the specific gravity of the gases, use may be made of a very simple instrument, consisting of a vertical tube, to the lower end of which a sensitive manometer is connected. By means of a pump, the gases are drawn out of the flue and caused to ascend this tube. The gases, being heavier than the outside air, produce a pressure at the base of the long vertical tube, and the measurement of this pressure affords a criterion of the composition of the gas, and consequently of the nature of the combustion process.

MICHIGAN GAS ASSOCIATION.

[From Our American Correspondent.]

The Fifteenth Annual Meeting of the Michigan Gas Association was held at Battle Creek (Mich.) from the 18th to the 20th of September; and I send herewith copies of the papers read.* The meeting was opened, in the presence of about 50 members, by the President, Mr. Victor F. Dewey, the General Superintendent of the Detroit City Gas Company, who conducted the proceedings in a thoroughly businesslike manner.

In the course of a short address, the President referred to the work of the Association, and pointed out that they were the pioneers in gas scholarship work of the State educational institutions of America. He remarked that during the past year experimental plant had been provided at Ann Arbor through liberal donations of apparatus and material; and he specially mentioned the liberality of the Ann Arbor Gas Company in providing building and grounds for the plant, which, when equipped with further additions to be made from time to time, would furnish facilities for more extensive work. Referring to the coal situation, the President said the present tendency of the price of gas coal was upward. This was caused by two things—first, the advance in mining rates; and, secondly, the increased demand for, and the diminished supply of, good gas coal. It had been estimated by United States geologists that, at the present rate of coal mining, the available coal supply of America would likely be entirely exhausted in 200 more years. If this was true of the coal supply as a whole, what life could be expected of the comparatively limited field of gas coals? They must make gas out of other coal. Their source of supply must be broadened, or the price would soon become prohibitive. The proper place to look for the correct solution of this problem was in the work of the Michigan Gas Scholarship and undertakings of a similar character. Dealing with the existing economic conditions of the gas industry, the President said the industry was confronted at the present time by two opposite and oppressive conditions. The materials out of which gas is made—coal, oil, machinery, supplies, and labour—had gone up in price, while the prices at which its products sold had gone down. The sole exception to this was in the price of coke, which had advanced slightly. The only hope of escape from decreased profits was in increased sales; and in the papers to come before the members special mention had been made of this feature of their business.

The new uses to which gas is put were due to the well-organized efforts of their Commercial Departments, whose work had been of twofold benefit to gas companies—first, in increased business; and, secondly, better service, which meant, in turn, the creating of a better feeling in the minds of the public towards gas companies. The properly organized Commercial Department was one that first of all saw that the consumer was given the best of service; and, secondly, coined that good service into increased sales. The labour situation was the most serious problem they had to deal with. Each manager, superintendent, and foreman was daily brought face to face with increasing wages and decreasing efficiency. This condition had been favourable to the introduction of labour-saving machinery wherever possible; but this, in turn, meant greater liability to accidents. Without machinery, accidents are rare, as it is in the careless handling and improper guarding of machinery that accidents generally occur. Having mentioned the passing of the Public Utilities Bill for the State of New York—a measure for regulating corporations holding grants or franchises for the use of streets and highways—the President concluded by referring to the progress made in the gas industry. He said vertical retorts on a large scale had been in successful operation in England and Germany, and fairly good results had been obtained. The introduction of silica blocks and tiles in bye-products coke-oven work had gone steadily on, and had given promise of much greater efficiency than the fire-brick material heretofore used; and if successful in coke-oven practice, why not, he asked, in retort practice?

After business of a purely local character had been disposed of, there arose a discussion on a proposition that the remarks of those who commented upon the papers should be edited by some person appointed for the purpose, as in a great number of cases participants in discussions, on the publication of their remarks, denied altogether saying things attributed to them, or, at any rate, wished they had said something more appropriate. The President had in view the editing of such remarks by the compilers of the respective papers; but in the discussion arising out of this it was considered that the author might act in a partisan spirit, and leave out all statements calculated to reflect on his judgment. Eventually it was decided that the Secretary should be given the task, and that he should send to each speaking member a copy of notes for correction and alteration. This, in my opinion, was a wise step, as gas engineers, as a rule, are not orators, and this fact debars many of them from speaking on topics which their experience fits them to handle, and the value of the Association work is thereby to a considerable extent lost.

A most interesting paper from the point of view of American gas engineers was read by Mr. J. R. Huntling, the Commercial Supervisor of Messrs. Child, Hulswit, and Co. This Company

* Two of the papers will be found elsewhere.—Ed. J.G.L.

is an important one in the gas trade, and owns quite a number of gas-works, which are managed and engineered by a skilled staff from the Grand Rapids office. The title of the paper was 'Some Notes on Obtaining All-the-Year Round All-Gas Kitchens." To English ears this may sound a trifle strange; but the climatic conditions in America warrant a great deal of thought and attention being given to the subject. In the greater part of the country, the average summer temperature is about 80° Fahr.; and then there is no difficulty in selling gas-cookers. But when in winter the average temperature is well below freezing-point, and sometimes keeps as low as 20° below zero for a week at a time, drastic changes are necessary in order to secure the consumers for cooking by "all-gas" all the year. The kitchen badly needs artificial heat in the winter, besides which the system of heating dining and living rooms is by hot-water radiators. The plan generally adopted is to use the coal-range during the winter for cooking purposes, and this heats the kitchen; and then there is a wood or coal furnace for hot-water heating in the other rooms. It is hard to believe, but the writer has not seen a single gas-fire in America; and at this meeting not one engineer spoke about it. The plan talked over was to have separate hot-water heating gas appliances for the house-warming; and a combination coke furnace for the kitchen was well spoken of. This in a number of cases is fitted with a bunsen burner to bring it in operation. One member asked why they should not make this coke furnace with a round or a dome top, so that it could not be used for supplementary heating and cooking purposes.

It is a strange thing out in the States, but in most parts houses are supplied with meters, and the pipes and services only connect gas for the kitchen—there being only a half-hearted attempt on the part of gas men to introduce gas for lighting living and bed rooms. It is hardly conceivable that one member of the Association advocated the soliciting of business by the aid of the open-flame burner, as he said the Welsbach burner did not use enough gas. This is one point on which the admittedly excellent commercial salesmen in America clearly require to have a lesson from England. They do not take advantage of the argument about relative costs of gas and electricity, or of gas and coal for cooking. They advertise gas all the time in good style; and they touch every argument except the one of cost to the consumer.

Another point is that too often the gas and electric lighting companies are in the hands of one concern; and as the chief officer is usually electrically trained, he pushes electricity as against gas. In quite a large number of towns the "gunning" system implies, in the wording of the advertising "guns," that gas is for cooking and electricity for lighting. In like manner, gas "arc" lamps are put on the salesman's list; but he has little argument to bring forward for their use in lighting the exterior and interior of shops, because the rival electric arc lamp is used in the gas company's office in place of the gas arc lamp.

The next paper was one by Mr. E. J. L'Esperance, the new Business Manager of the Saginaw and Bay City Gas Company. It had for its title: "Ways and Means to Increase Gas Sales." This paper really called for little discussion on its suggestions. But the title brought one or two members to their feet; and so the paper served a useful purpose.

Perhaps the most interesting theme was the talk arising out of a request by the President that Mr. Alonzo P. Ewing should tell the members how his Company managed to get the large hotels in Detroit to use gas for cooking. This matter was ably set forth by the Secretary in his reply. In the main, it was that the Company endeavoured to "deliver the goods" all the time. To obtain a foothold, the Company took a hotel with eight coal-ranges, and induced the manager to put in two gas-ranges and one coal-range, and then two more gas and one more coal, and so on. In this way the hotel kept the coal fires on for steady work, and used gas for the "peak load" and other emergencies. So much better and cleaner was the gas found for work, that the Company had no difficulty in getting the gas-stoves extended. The one necessity was to keep the burners clean; and special men are deputed to make regular visits to all the hotels for this purpose. In no case where a complaint was made did they allow more than 30 minutes to elapse before the cause was removed.

The President endeavoured to raise a discussion on sliding-scale rates for gas supply; but, despite the importance of the question, it caused little debate. One prominent gas engineer said his franchise allowed charges of $1·45 (about 6s.) for gas for light and $1 (4s. 2d.) for fuel; but if they were to charge these amounts there would not be much profitable business. Some little time ago his Company endeavoured to even-up the use of gas so as more approximately to cover the rate of manufacture, and induced the owners of a large industrial plant to put in gas at a cost of 50 c. (2s. 1d.) per 1000 cubic feet. This plan works particularly well, as the difference between the peak and the ordinary load is now only about 3 per cent. This means that the distributing system is worked more nearly to its capacity all the day, and therefore the Company reckon they can sell at a profit the gas at this (for America) low rate. So far as the tone of the remarks at the meeting is concerned, the prevailing idea must be taken as not being in favour of a sliding-scale charge.

Another point which must seem inexplicable to English gas men is the absolute silence of their American colleagues respecting gas-engines. This is not accounted for by the fact that they are considered as being firmly established in the business, as the writer knows of only one or two exceptional cases in the United States where these engines are used, and he has had a good chance of seeing them if they exist, having travelled about 30,000 miles in nine months. Such lethargy is difficult to understand; but it may be accounted for by the price of gas-engines. Figures were obtained from American gas-engine makers for large sets, and the price was $45,000, against from $16,000 to $21,000 for English engines f.o.b. Liverpool. It is not too much to say that, if English makers care to do so, they can ship engines out to America, pay freight, 15 per cent. duty, and insurance, and then undersell the home product. American designs cannot be compared to English, as they are far too complicated; and it is certain English engines have only to be introduced to find a ready sale. Later on factories could be started to build engines on the spot.

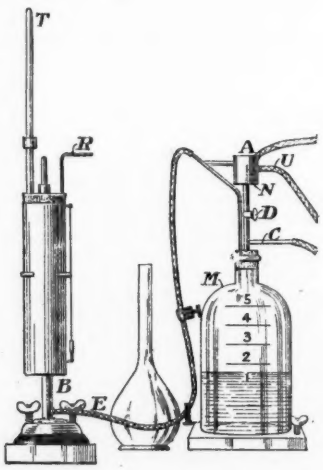
The meeting was adjourned at one o'clock for luncheon, and in the afternoon the members were taken by a special car to the works of the Postum Cereal Company, Limited, located in the city. This place is the home of the cereal foods, and has at present a population of 30,000, not counting the 3000 odd people who are patients at the Sanatorium, and who spend there, on an average, £2000 a day seeking health. The Company claim to have the finest suite of offices in the world. This seems to be a big claim until the offices are inspected. This world-famous Company had its beginning in Battle Creek on January 1, 1895, in a little barn belonging to Mr. C. W. Post; but its buildings now cover 10 acres, and the profits made last year are said to have been nearly $12,000,000. A feature of the works is that there is absolutely nothing secret about them. In the words of the owners: "The door is unbolted—walk in." The interest does not end here, as a smart young man takes you round, shows the entire plant, and tells you everything connected with the manufacturing operations going on. Here are some figures which show how gigantic the plant is. The elevators handle 2000 bushels of wheat and barley every 24 hours, making 17,000 loaves of 8 lbs. each every day; and 700 lbs. of lard are used each week for greasing the pans for holding the dough. The machine for cutting the loaves cuts and forms twenty a minute. The Company send out 82 carloads every week. The cars are not like those in England, but hold about 50 tons each. Yet in this factory there is not a gas-jet or a gas-furnace!

For a subsequent issue I hope to be able to send notes of some of the discussions arising out of the papers. I will only now add that at American meetings the social side is not lost sight of. In the present case the aid was by a dinner at the County Club, followed by an entertainment for which highly-paid artists were engaged.

THE GRAEFE GAS CALORIMETER.

A German Arrangement.

A recent issue of the "Journal für Gasbeleuchtung" contains a short illustrated note by Herr H. Pleyer, of Gottesberg, describing an instrument brought out a few years ago by Dr. E. Graefe, of Webau, for determining the calorific power of gases. The advantages claimed on behalf of the apparatus are that it is much simpler, and therefore cheaper, than the Junkers calorimeter; that it can be used without any meter to measure the gas consumed; and that it enables an estimation to be completed in a much briefer period of time than hitherto possible. Hence the calorific power of (*e.g.*) a material in process of manufacture may be determined before it has had opportunity to alter in composition and thermal value.



Shown in the accompanying illustration, the Graefe calorimeter consists of a nickelled brass cylinder supported on the ring of a retort stand, provided with the thermometer T, graduated in tenths of a degree, and with the stirrer R. The vessel M for measuring the gas is a glass bottle holding about 5 litres, and graduated from below in the manner shown. It is fitted with

a pipe A for filling it with water, and with an arrangement N for automatically setting the level of the liquid; also with a pipe C leading to a sink, and a pipe E which can be attached either to the tube delivering gas to the apparatus or to the burner B of the calorimeter. The entire apparatus is used in the following manner: The calorimeter itself is filled with exactly one litre of water, and the thermometer is inserted in such a position that its bulb is submerged to a depth of 5 cm. The stopcock D is next opened and that on C shut; water being allowed to flow in through the top tube A (at the right of the diagram) until it overflows through the pipe U. The cock D is then shut, E is connected with the gas supply, and the pipe C is employed as a syphon to empty the bottle of water and to draw gas in to take its place. When the bottle is completely full of gas, E is connected to the burner, the gas is lighted, and the stopcock D is so regulated that the flame is constantly between 2 and 3 cm. in height. While the gas is flowing out of M, water is admitted through the inlet pipe A at such a speed that some regularly overflows through U. This causes the pressure in the bottle to remain constant throughout the experiment. During the combustion of the gas, the stirrer R is manipulated in the usual manner; and finally the maximum point to which the mercury rises in the thermometer above that which was indicated at the beginning of the test is read off.

Though the combustion chamber of the calorimeter is provided with several wire gauzes to assist in the transference of the heat, some loss naturally occurs from the walls of the instrument. The apparatus is therefore first of all calibrated against a Junkers calorimeter, and a permanent correction thereby obtained for the readings. It is very important that the apparatus itself shall be truly perpendicular, that the flame shall be exactly in the centre, and that its tip shall extend about 2 cm. upwards into the combustion chamber. Graefe calorimeters were originally provided with bunsen burners; but the present plan of giving them luminous flames is preferable. The calorimeter yields very accurate results, and indicates the net calorific value of a gas containing hydrogen. Its use enables two analyses to be performed within 20 minutes. Very poor gaseous fuels that will not burn alone can be consumed in a blowpipe fed with oxygen from a generator or cylinder. In calculating out the results, the rise shown by the thermometer is divided by the number of litres of gas burnt (2 litres in the case of a concentrated fuel, more if necessary) and then by the proper factor.

The above-mentioned note is followed in the German journal by a few words from the pen of Dr. Graefe, the inventor of the calorimeter. He states that his idea in designing it was to provide a small portable instrument primarily intended for the estimation of calorific value in still gas. When the operator has gained sufficient practice, the results given by the instrument do not differ by more than 3 per cent. from those obtained in the Junkers. For example, three different samples of still gas were examined in both calorimeters. The first, which had a true calorific value of 1520 large Calories per cubic metre, gave in three successive tests 1475, 1475, 1480 Calories in the Graefe; a second sample, which gave 1850 Calories in the Junkers, gave 1815 in the Graefe; while a third, which gave 1380 in the standard instrument, gave 1350 in the small calorimeter. The statement that the Graefe instrument yields net calorific value is true for such gases as do not differ in their gross and net calorific values by much more than 10 per cent.—a proviso which renders the assertion valid for such materials as still gas, coal gas, and oil gas. Herr Graefe admits that his calorimeter is not suitable for purposes in which a greater accuracy than 3 per cent. of error is requisite; but he considers that this limit is none too wide for an instrument used for technical purposes, where great rapidity is very advantageous.

Thoria in Ceylon.

A report (No. 42) on the results of the mineral survey of Ceylon in 1905-6, by Professor Wyndham R. Dunstan, M.A., F.R.S., the Director of the Imperial Institute, contains some further interesting particulars in regard to the collection of thorianite in the island. He states that it has already yielded a handsome return since the value of the mineral was made known in 1904. But of scientific interest as well as of commercial importance is the fact that the monazite of Ceylon is richer in thoria, and therefore correspondingly more valuable, than that obtained in other localities—one specimen containing no less than 14 per cent. of the valuable rare earth. Mr. James Parsons, B.Sc., the Principal Mineral Surveyor, has carried out a number of investigations; and the salient feature of his reports is the discovery of thorianite in minute crystals in alluvial sandy beds as well as *in situ* in decomposed crystalline rocks. A sample of black sand from Weralupe dola, Ratnapura, with gold and thorianite, contained 19 per cent. of the latter and 11 per cent. of monazite. A representative portion of the specimen was analyzed, and gave 13·44 per cent. of thoria and 6·41 per cent. of ceria and associated oxides. Thorianite, tinstone, monazite, and gold were all present in this concentrate in quantities which, it is stated, would repay working; and the commercial value of a concentrate of this composition, calculated from the present values of these four constituents, and excluding the cost of separation, would be about £212 per ton. For particulars as to other samples, reference may be made to the report itself.

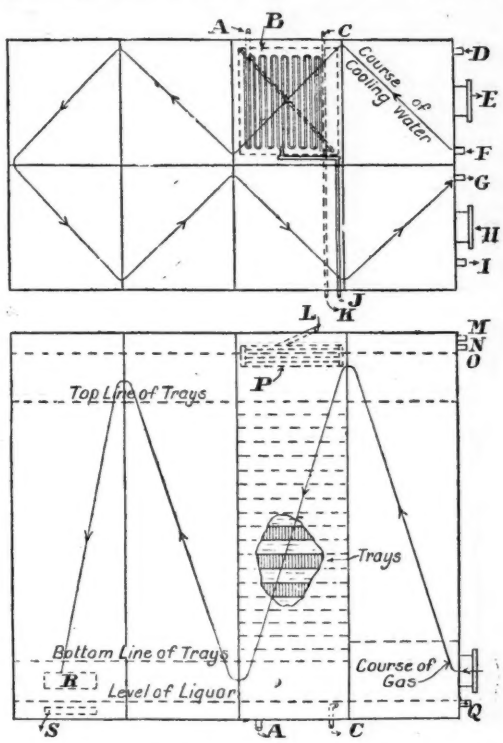
NEW METHOD OF CONDENSING AND SCRUBBING.

By W. Seymour, of Grand Rapids.

[Extracts from a Paper read before the Michigan Gas Association.]

Though it cannot be said that no material changes were introduced into gas manufacture in the latter half of the Nineteenth Century, it is true that these changes have been almost entirely in the development of the apparatus in use rather than in the methods employed. But of late years there seems to have come an awakening; and more attention is being paid to the development of new methods, and necessarily to the chemical side of gas manufacture. This enlivenment may be ascribed to the combined influence of several causes, among which may be mentioned: (1) The increased use of gas, due to the rapid development of the gas-engine as an economical method of producing power; (2) the rapid increase in the use of gas for industrial purposes; (3) the sources of profit found in the development of the bye-products; (4) the increasing cost of the material used in the manufacture of present apparatus.

Coal gas, when it comes from the retort, contains several impurities which must be removed in order to put the gas into a condition to be used for fuel and lighting purposes without causing trouble. The most important of these are tar, ammonia, hydrogen sulphide, water vapour, and in some cases naphthalene



A. Drain. B. Cooling coil (one for each section). C. Suction line. D. Fresh water inlet. E. Gas outlet. F. Cooling water inlet. G. Cooling water outlet. H. Gas inlet. I. Liquor outlet. J. Discharge of circulating pump. K. Suction of circulating pump. L. Discharge line. M. Water outlet. N. Water tap. O. Water inlet. P. Distributing apparatus. Q. Liquor outlet. R. Gas passage. S. Liquor passage.

The Doherty Washer-Cooler.

to an extent. The first step in the removal of these impurities is condensation. On account of the great irregularity in the production of gas, together with the variable influences of most climates, perfection in condensation is hard to attain. Whatever may be the form of condenser, certain precautions are necessary in order to ensure successful operation. For example, the apparatus should be protected from the influence of excessive cold, as this may cause the condensation to be so rapid as to remove a considerable proportion of the illuminating constituents of the gas, &c. Though the condenser is an apparatus that is most essential in the manufacture of gas, there is none that until recent years has been so little understood. For some time the condenser which could reduce the gas to the lowest temperature in the shortest time was considered the best. The condensers remove a large amount of the tar and water vapour and some ammonia, and also put the gas in condition for further purification.

The scrubber, as employed at present for removing ammonia, was first used for absorbing muriatic acid gas. Since it was introduced into gas manufacture, various substances have been used for filling—such as coke, wooden trays, &c. With the exception of the rotary scrubber, it has undergone but slight alteration since the first few years after its invention. There seems to have been no attempt to combine the condensing and scrubbing process.

To the demand for a more economical method of washing and scrubbing gas may be ascribed the invention of the Doherty washer-cooler; and in order to try it, it was installed in the plant of the Grand Rapids Gas Company. It consists essentially of a sheet-steel box divided into eight sections, and so arranged that the gas enters at the bottom of the first section, goes up, across, and down the second, up the third, &c., and finally down through the eighth and out. Each section is filled with wooden trays, and the cover is put about a foot below the top of the cooler, so as to make a water reservoir in which cooling-coils are placed. For each section a small rotary pump takes the liquor from the bottom of that section, forces it through the cooling-coils in the reservoir of that section on top, and in at the top of the same section through a distributing arrangement. Fresh water is admitted at the eighth section (for convenience the sections are numbered from one to eight in the direction of the flow of the gas), and the excess flows from one section to the next, and finally out at the first section; the water-level in the bottom being high enough to supply the pumps and seal off the openings between the sections for the flow of liquor. The fact that thirty or forty times as much heat is transmitted from water to water as is transmitted from water to air is made use of in this washer-cooler; and therefore not nearly so much cooling surface is needed.

The first tests made were for the purpose of determining the amount of fresh water necessary for the complete removal of the ammonia under the conditions of temperature, &c., as given in the tests. At the same time, the percentage of sulphuretted hydrogen in each sample was determined. In these tests the fresh water was started at the rate of 3·72 gallons per 1000 cubic feet, and two tests were made at or near this rate. Then the rate was lowered, and two more tests were made. After each reduction in rate, the gas at the outlet was tested qualitatively, with litmus, for ammonia. It was found to be difficult to get duplicate tests on account of varying amounts of gas, &c. The tests for sulphuretted hydrogen in the gas are given in grains per cubic foot, and, on account of difficulty in sampling, the results cannot, with the exception of the inlet of the first section and outlet of the eighth, be relied upon to any very great extent. In all the experiments the gas rate was about 65,000 cubic feet per hour. When the rate of fresh water had been lowered to 2·28 gallons per 1000 feet of gas, the qualitative test at the outlet indicated that there was an excessive loss of ammonia. Therefore, under the conditions of temperature, &c., which were present during the test (*i.e.*, about 70° Fahr. outlet and 100° Fahr. inlet temperature), it was found that a fresh water rate of 2·5 gallons per 1000 cubic feet was necessary to remove the ammonia. A few conclusions may be drawn from these tests.

It is shown that when the percentage of ammonia in the liquor has risen to a certain point (determined mainly by the temperature and the percentage of ammonia in the gas), the liquor will not absorb any more ammonia; and also if the liquid is saturated with ammonia at one temperature and with a given percentage of it in the gas, and then the temperature is raised, other conditions being the same, the liquor will give up some of its ammonia. The amount of sulphuretted hydrogen removed does not vary as the percentage of ammonia, but seems to be more a function of the temperature; and it is undoubtedly influenced to a great extent by the percentage of carbon dioxide in the gas, as where sulphuretted hydrogen has combined with ammonia, and then is brought into the presence of carbon dioxide, the sulphuretted hydrogen will be replaced to a greater or less extent, depending on the conditions of temperature and the mass action.

At this time it was impossible to proceed further with the experiments, because the coming of warm weather made it impossible to properly cool the gas in the washer-cooler. Therefore an investigation of the cooling coils and the efficiencies of transmission of heat was made. The coils used for cooling the crude liquor are made up of fifteen 4-feet lengths of 1¼-inch pipe connected with return bends—the inlet being a Y at the middle, and the outlets being at opposite corners.

Experiments were first made on two different coils to determine the rate of pumping and drop of pressure through the coils:—

Experiment on No. 3 Coil.

	Cubic Feet Per Minute.	Pressure at Inlet in Inches of Mercury.	Pressure at Outlets in Inches. 1.	2.	Loss of Pressure. Inches.
1	7·2	12·0	1·8	1·8	10·2
2	6·8	9 8	1·5	1·5	8 3
3	5·0	6·5	1·2	1·2	5·3
Average	6·3	9·4	1·5	1·5	7·9

No. 7 Coil.

1	6·6	9·3	1·5	1·5	7·8
2	5·9	8·1	1·4	1·4	6·7
3	4·6	6·4	1·3	1·3	5·1
Average	5·7	7·9	1·4	1·4	6·5
Average of 3 and 7	6·0	8·5	1·4	1·4	7·2

These experiments show that the average rate of 6 cubic feet per minute gave an average drop of 7·2 inches of mercury, or about 3·5 lbs.

After these experiments the coils on sections 1, 2, 3, and 4 were doubled by connecting a coil similar to the first one in parallel with it. Then similar experiments were made on the double coils:—

Experiment on No. 3 Double Coil.

	Cubic Feet per Minute.	Pressure at Inlet of Coils. Inches.	Pressure at Outlet in Inches. 1.	2.	Loss in Pressure Inches.
1	7·2	5·4	1·8	1·8	3·6
2	8·4	7·0	2·1	2·1	4·9
3	10·0	8·3	2·5	2·5	5·8
Average	8·5	6·9	2·1	2·1	4·8

Experiment on No. 1 Double Coil.

1	7·2	4·5	1·8	1·8	2·7
2	8·4	6·0	2·3	2·3	3 7
3	10·0	7·3	2·5	2·5	4·8
Average	8·5	5·9	2·2	2·2	3·7
Average of 1 and 3	8·5	5·9	2·15	2·15	4·25

These experiments show a greater average rate of liquor, due to less drop in pressure through the coils. So not only was the cooling surface doubled, but also the rate of liquor was increased, giving more efficient scrubbing.

Experiments were also made at this time to determine the rate of transmission of heat through the cooling coils.* They showed that the average number of heat units transmitted by the coils per square foot of surface per degree difference in temperature per hour was about 40. This result is low; but even at this it is twenty-five to thirty times as much as from water to gas. When the experiments had progressed thus far, they were discontinued, as the increasing amount of coal gas produced and the warmer weather experienced made it impossible to keep the temperatures where they should be.

Summing up the advantages of the washer-cooler, they are: (1) As the transmission of heat from water to water is about forty times as much per unit surface as from water to gas, only about 1-40th as much surface is needed—making a great difference in the cost of the apparatus; (2) it makes a very efficient scrubber; (3) it is easy to clean, as by heating the circulating liquor any naphthalene may be washed down and then drained off at the bottom. There are other points which might be investigated. For example, it would seem that one or two sections might easily be isolated for a naphthalene scrubber where this is necessary.

* Owing to the use of river water for cooling water there was deposited on the coils a thin layer of slime, which may account for the results obtained being lower than those given for the transmission of heat from water to water.

Water Rate. Galls.	Section 1. Average Temperature. In.	Out	NH_3 Per Cent.	H_2S Content. In Gas. Grs. per 100 Cubic Feet. In.	Out.	In Liquor Per Cent.	Section 2. Average Temperature. In.	Out.	NH_3 Per Cent.	H_2S Content. In Gas. Grs. per 100 Cubic Feet. In.	Out.	In Liquor Per Cent.
3·72	104	100	1·24	370	330	0·34	100	95	1·03	330	350	0·24
3·73	105	98	1·24	460	450	0·31	98	90	1·03	450	460	0·30
2·79	101	96	1·51	350	330	0·19	96	87	1·35	330	320	0·22
2·56	97	90	1 67	470	430	0·34	90	83	1·52	430	430	0 35
2·28	101	96	1·69	340	340	0·22	96	90	1·66	340	340	0·31
2·08	108	100	1·72	360	360	0·27	100	90	1·77	360	360	0 27
1·93	97	94	1·83	350	340	0·31	94	92	1·82	340	340	0·31
1·85	111	102	1·72	330	330	0·28	102	94	1·84	330	330	0·28
	Section 3.						Section 4.					
3·72	95	92	0·76	350	360	0·24	92	83	0·56	360	350	0·19
3·73	90	87	0·74	460	440	0·28	87	78	0·51	440	420	0·21
2·79	87	85	1·03	320	310	0·22	85	87	0·89	310	310	0·20
2·56	83	80	1·18	430	420	0·35	80	76	1·03	420	410	0·32
2·28	90	88	1·53	340	310	0·29	88	82	1·36	310	310	0·29
2·08	90	88	1·66	360	360	0·28	88	81	1·54	360	360	0·30
1·93	93	89	1·67	340	290	0·33	89	82	1·56	290	290	0·33
1·85	94	88	1·85	330	300	0·30	88	82	1·80	300	300	0·30
	Section 5.						Section 6.					
3·72	83	82	0·39	350	330	0·18	83	77	0·22	330	320	0·09
3·73	78	76	0·31	420	420	0·17	76	73	0·17	420	420	0·09
2·79	77	75	0·60	310	300	0·17	75	72	0·39	300	300	0·12
2·56	76	74	0·73	410	410	0·24	74	72	0·50	410	400	0·18
2·28	82	80	1·07	310	310	0·26	80	76	0·78	310	300	0·20
2·08	81	79	1·19	360	360	0·27	79	75	0·85	360	360	0·22
1·93	82	81	1·30	290	290	0·30	81	78	0·99	290	290	0 25
1·85	82	80	1·50	300	300	0·30	81	78	1·17	300	300	0·26
	Section 7.						Section 8.					
3·72	77	73	0·10	320	350	0·02	73	68	0·01	350	330	tr.
3·73	73	71	0·08	420	420	0·05	71	68	0·01	420	400	0·04
2·79	72	70	0·18	300	290	tr.	70	69	0·02	290	290	tr.
2·56	72	70	0·24	400	380	0·11	70	69	0·05	380	380	0·01
2·28	76	73	0·46	300	300	0·15	73	72	0·10	300	300	0·05
2·08	75	72	0·50	360	350	0·18	72	72	0·11	350	320	0·06
1·93	78	76	0·58	290	290	0·18	76	76	0·26	290	290	0·09
1·85	78	75	0·77	300	300	0·23	75	76	0·38	300	300	0·15

STUDIES IN THE MANUFACTURE OF COAL GAS.

By Alfred H. White and Frederick E. Park.*

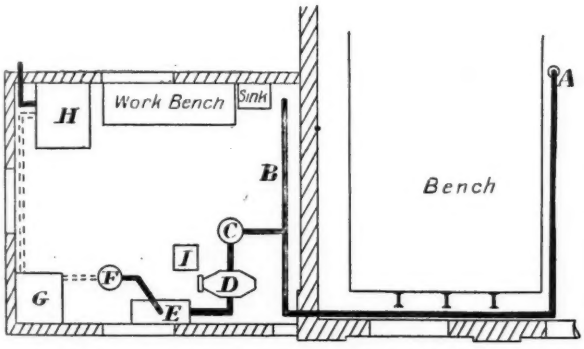
[A Paper Presented at the Annual Meeting of the Michigan Gas Association.]

The present paper is the seventh to be presented to the Michigan Gas Association as the result of its support of a Fellowship in Gas Engineering at the University of Michigan. At your last annual meeting, it was voted to erect an experimental plant in connection with the works of the Ann Arbor Gas Company, where the factors influencing gas manufacture and purification might be more closely controlled and better studied than had been possible in tests made on full-sized plants. Your Committee having charge of the matter decided that the plant should consist of complete condensing and purifying apparatus designed small enough to be suitable for the investigation of the products from a single retort. It was hoped at the time that it could be equipped within a few weeks; but the manufacture of the special apparatus went slowly, and it was not till the 27th of April that the completed plant was ready. This paper is in the nature of a preliminary report of its operation.

It is customary to preface such a report with a review of what has been done by previous experimenters. The most conspicuous example of previous work of this sort on American coals is found in the admirable paper read before your Association three years ago by your present President.† There is more literature available on the subject of the treatment of European coals; but most of the tests that have been made have been conducted for the purpose of testing the coal for its gas-making qualities under given conditions of manufacture, rather than testing the effect of variations in the process of manufacture as the principal object of the investigation. The literature is at best conflicting, and in this paper we have deemed it wiser to omit altogether a review of it.

Description of the Experimental Plant.

The condensing and purifying apparatus is installed in an annex to the retort-house of the Gas Company; and a plan of it and of a portion of the adjacent retort-house is shown on fig. 1. The gas



A. Stand pipe. B. Condenser. C. Pelouze and Audouin tar separator. D. Exhauster. E. Tar washer. F. Scrubber. G. Purifier. H. Meter. I. Engine.

Fig. 1—Plan of Experimental Plant.

is taken from a single retort, which has been the same one during the tests reported here. It is ∩ shaped, 26 in. by 16 in. and 9 feet long, and is one of the upper retorts of a modern bench of sixes, with three-quarter depth regenerative settings. It was selected because of its convenience of location; but it happens to be one of the hottest retorts in the house. It is in regular use by the Company. When it is to be employed for experimental purposes, the cap is removed from the top of the bridge-pipe, and a 4-inch pipe clamped and luted on in its place. This pipe leads with a run of 32 feet of 4-inch pipe to the condenser in the annex, where the experimental plant is located.

It was desired to make this condenser as flexible as possible, so that the condensing surface could be diminished or increased as desired, and so that the changes taking place during the cooling of the gas could be studied. It was therefore built up from pieces of 3-inch pipe coupled together into a zigzag; the gas entering at the top, and working backwards and forwards through almost horizontal pipes until it reaches the bottom. In fig. 2 is given a detail of the condenser, showing how the temperatures are taken, and the

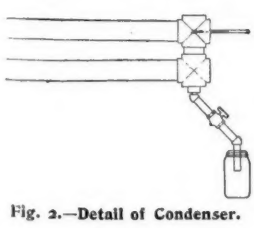


Fig. 2.—Detail of Condenser.

condensed products drawn off into glass fruit-jars for measurement and examination. Following the condenser is a Pelouze and Audouin tar-separator. The gas then goes to a small Roots exhauster, which was placed after the separator, so as to avoid the complication of having to consider the action of the exhauster as a tar-remover in addition to its regular function. A tar-washer is the next piece of apparatus. It is followed by a tower scrubber made from a piece of 16-inch water-pipe filled with coke and provided with a water-spray. A purifying-box, 3 feet square, followed by a 3 cubic feet station meter, completes the equipment. With a few additions we hope to make later, this equipment makes possible a study of the process of destructive distillation from commencement to close, with a simultaneous examination of the processes of condensation and purification.

Operation of the Experimental Plant.

It seemed best, at least at the commencement of the work, to confine the test to observations of a single four-hour charge, making all the observations which were considered to be of possible value, and for which equipment was at hand. A test of this sort is always interesting to University students, and there is no trouble in getting any desired number of helpers. There have been ten men usually employed on the tests so far made. Unfortunately, after each test must come a very large amount of mere routine analytical work in the laboratory, which falls on the one or two people specially interested; so that it has taken nearly a month to complete the analysis of one test.

The method of operating the plant was in general the same in all cases, and was as follows: The charging of the retort was done by the regular retort-house men in the usual manner. In the interval between drawing the old charge and putting in the new one, the cap on the top of the bridge-pipe was swung back, and the pipe connecting to the experimental plant put in and bolted down. The experimental exhauster had already been running for about 15 minutes, pulling air and steam from a special line through the condenser to preheat it to what would be about a normal working temperature. Just before the retort was charged, this steam was cut off, and the drips on the condenser opened to let out the condensed steam. The glass jars were then screwed on to the drips, to catch the liquid as it condensed; and at the signal from the retort-house the first meter reading was taken and the test started. During the test, readings were made every five minutes of the temperature and pressure at the top of the stand-pipe, of the temperature at the inlet to the condenser, the temperature at the inlet to the Pelouze and Audouin tar-separator, and the differential pressures on this and the washer. In addition, the readings of the meter and the temperature of the gas leaving the meter and the room temperature were observed at the same intervals. Every half hour during the first two hours of the run, and every hour during the last two hours of the run, the jars on the condenser drips were changed, and the tar drawn off from the separator. These samples were all saved for later examination. As nearly as might be during the same periods, tests were made at the inlet and outlet of the separator and the inlet of the meter, to determine the suspended tar and naphthalene in the gas at these points. Tests for ammonia in the gas were also made at the inlet to the tar-separator. At approximately the same intervals, gas analyses also were made from the inlet to the meter. These analyses were carried out on the spot to prevent the condensation of hydrocarbons possible if the gas had been transferred to the laboratory. But the confusion and rather crowded quarters did not conduce to the greatest accuracy, and the results were not altogether satisfactory. Lack of equipment prevented measurement of the candle power of the gas. The want of an electric pyrometer also prevented the continuous measurement of temperatures inside the retort; but that of the retort was measured by an optical pyrometer after the coke had been drawn—this single determination being the only one made.

In all, six tests were made in this manner, though the first three were preliminary and incomplete. Tests Nos. 4, 5, and 6 are available for presentation; but it has seemed best to present only Nos. 5 and 6, which were made with coal from an identical lot, and with a retort temperature nearly the same in both cases. The variation in the two tests lies in the weight of coal charged; No. 5 being made on a heavy charge and No. 6 on a light one. These two tests will give an idea of the scope of the experiments, and also of the differences which may be caused by alteration in the weight of coal charged.

Influence of Size of Charge on Products of Destructive Distillation.

Tests Nos. 5 and 6 were made with coal from one lot of Youghiogheny three-quarter lump, the proximate composition of which was as follows:—

	Per Cent.
Moisture	1·26
Volatile combustible	34·78
Fixed carbon	57·22
Ash	6·64
	99·90

The charge in test No. 5 was 470 lbs., and in No. 6 only 350 lbs. Both charges were drawn after they had been four hours in the retort, though the heavy charge was incompletely carbonized.

The coke flamed as it was drawn from the retort, and the rate of evolution of gas had hardly commenced to slacken at the end

* Mr. Park is the holder of the Michigan Gas Association Fellowship in Gas Engineering at the University of Michigan for 1906-7.

† "Temperature as Applied to the Production of Coal Gas," by Mr. V. F. Dewey. See "Journal," Vol. LXXXVIII., p. 469.

of the period. The following table gives the weights and percentages of the various products of destructive distillation:—

TABLE I.—*Products of Destructive Distillation.*

	Test No. 5.		Test No. 6.
Weight of Coal Charged . .	470 lbs.	..	350 lbs.
Products in pounds—			
Coke	340·0 = 72·4 p. ct.	..	240·0 = 68·6 p. ct.
Gas	74·5 = 15·8 ,,	..	64·6 = 18·4 ,,
Tar	26·1 = 5·5 ,,	..	27·2 = 7·8 ,,
Ammoniacal liquor . .	20·1 = 4·3 ,,	..	21·2 = 6·1 ,,
Total	460·7 = 98·0 p. ct.	..	353·0 = 100·9 p. ct.

Expressing these results in a little more customary manner, and adding a few more data, we get the following table:—

TABLE II.—*Yields per Ton of Coal.*

		Test No. 5.		Test No. 6.
Coke	lbs.	1484·00	..	1,372·00
Gas.	cub. ft.	9260·00	..	10,780·00
Tar	gallons	11·60	..	15 60
Ammoniacal liquor .	,,	10·30	..	14·40
Ammonia	lbs.	3·95	..	4·58
Naphthalene . . .	,,	5·95	..	10·04

This makes a distinctly better showing for the light charge. But it may be urged that the comparison is unfair to the heavy charge, which might have been advantageously left in the retort another hour. There is some truth in this; but, assuming that the gas would have continued to be evolved for another hour at

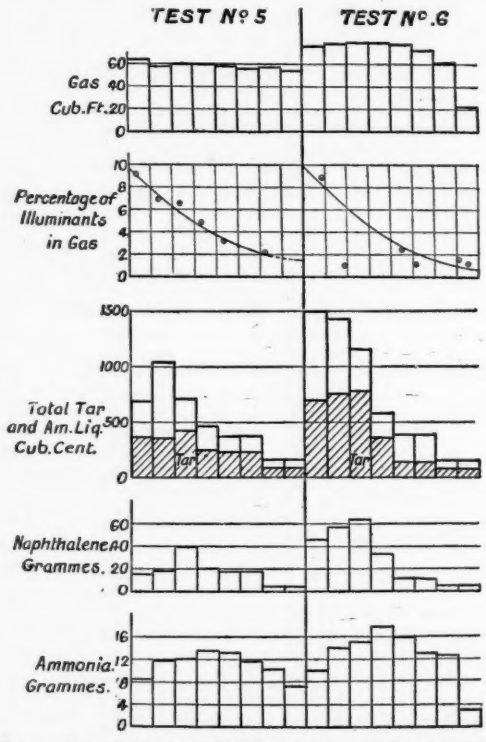


Fig. 3.—Total Products of Distillation from 100 lbs of Coal by Half-Hourly Intervals.

approximately the same rate as during the last half hour observed, one additional hour's heating would have added 500 cubic feet of gas to be credited to the heavy charge, which would amount to an additional 1060 cubic feet per ton. But this would still be below the results with the lighter charge; so that, though it is not possible to settle the point conclusively, it appears as if the heavy charge would, even if heated longer, have produced a smaller yield of gas per ton. An inspection of the curves in fig. 3 will show that another hour's heating would not have added much to the tar, and that the ammonia had begun to fall off so rapidly that another hour's heating would have added only a relatively small amount to that, so that the yield of tar and ammonia per ton of coal would have undoubtedly been less with the heavy charge. On the other hand, the naphthalene per ton of coal was 75 per cent. greater with the light charge.

The quality of gas manufactured is almost as important as the quantity; but the relative candle power of the gas in the two cases could not be determined, since the experimental plant is not equipped with a photometer bench. The chemical analysis of the gas should afford some indication of the difference by comparison of the percentages of "illuminants." The term "illuminants" is here taken to mean the sum of the hydrocarbon vapours and the unsaturated hydrocarbons. The two tests start out almost together in this respect, and end with a small advantage for the heavier charge. The analyses of the successive periods of test No. 5 form when plotted almost a straight line, as shown in the diagram fig. 3. The analyses of test No. 6 are unfortunately not complete. The first analyses show about the same results as No. 5; but the illuminants in the only other sample taken during the first two hours drop so far below what might be expected, that it seems it certainly must be an error, and that it is best to regard as inconclusive the evidence as to the quality of gas.

PRODUCTS OF DISTILLATION IN SUCCESSIVE HALF-HOUR INTERVALS.

The yield of products by successive half-hour intervals reduced to a unit weight of 100 lbs. of coal is shown graphically in the diagram. The rate of evolution of gas holds fairly steady throughout all four hours of test No. 5, but drops off rapidly during the last hour of No. 6 with the lighter charge. The liquid products of distillation show a greater variation. The light charge starts off with a heavy yield of tar and water the first half hour. The water decreases rapidly and fairly regularly for the first three half-hour periods, and then stays quite steady at a quarter of its initial amount till the last hour. The tar, on the other hand, though it starts high, increases slightly for the first three half hours, and then drops abruptly. There is thus a large drop in the liquid products of distillation at the end of the third half hour; but, somewhat unexpectedly, the yield of gas, instead of showing a corresponding drop, starts nearly constant for three more half-hour periods.

The effect of the heavy charge of test No. 5 shows itself in a low yield of tar and water per 100 lbs. of coal during the first period, followed by a heavier yield during the second half hour, but one which is still not so high as test No. 6. The tar reaches its maximum during the third half hour, as in test No. 6, and then falls off much more gradually than with the lighter charge.

The striking feature of these results is the very large amount of tar and water evolved during the first part of the run by the light charge, and the sudden slackening of the liquid products an hour and a half before the yield of gas slackened.

A study of the rate of naphthalene formation shows that the rates of production of tar and naphthalene are fairly concordant. The curves showing the production of tar and naphthalene in fig. 3 indicate corresponding irregularities; but the rate of naphthalene evolution, on the whole, increases more rapidly than that of the tar. As the relation of tar to naphthalene is an important one, the weight of naphthalene produced per 100 lbs. of tar in each successive interval is given below.

TABLE IV.—*Pounds of Naphthalene per 100 lbs. of Tar.*

Half-Hour Periods.		Test No. 5.		Test No. 6.
1	..	3·7	..	5·5
2	..	4·4	..	6·3
3	..	7·6	..	6·8
4	..	6·9	..	7·7
5, 6	..	7·0	..	8·3
7, 8	..	6·9	..	11·3

In test No. 6, the ratio of naphthalene to tar increases slowly from the beginning to the end of the test. In test No. 5 it takes a bound in the third half hour, then drops back a little, and stays almost constant to the end. It would be idle, from the data at hand, to speculate upon the reasons for these differences. As a consequence of them, however, we might expect that, if naphthalene trouble were to be encountered at any time in test No. 5, it would be in the third half hour, and that in test No. 6 the trouble would increase towards the end of the test.

The yield of ammonia, as shown graphically in the diagram, presents the most regular succession of changes of the set. In both tests the evolution of ammonia increases gradually for four half-hour periods, and then decreases at about the same rate. Each change shows a rather decided drop during the last half hour; the drop in the case of the light charge being very marked. The total yield of ammonia was calculated from analysis of the individual samples of liquor collected, and from determinations of the amount of gaseous ammonia still in the gas at the inlet to the separator.

WORK OF THE CONDENSER.

In designing the condenser for the experimental plant, the intention was to make it long enough to allow the gas to remain in it in contact with the tar vapours as long as is customary in commercial practice. This would give an unduly large amount of condensing surface with our small 3-inch pipe; but the condenser was installed this way with the idea that it was easier to cut out sections if it was too large than it would be to put in sections to make it larger. The condenser—including under this name all the pipe between the stand-pipe of the retort and the Pelouze and Audouin tar-separator—contained, as originally built, 32 feet of 4-inch and 184 feet of 3-inch pipe. This gave it 228 square feet of condensing surface, which corresponds to upwards of 400 square feet per 1000 cubic feet of gas per hour. The preliminary tests showed that the cooling effect of this long condenser was too great to bring the gas to the inlet of the tar-separator at anything like a commercial temperature. Even when the condenser was preheated by a steam-jet, and the pipes of the condenser were covered closely by a large tarpaulin, the temperature at the inlet to the separator, which started at 120° Fahr., fell in an hour to 80° Fahr., and before the close of the run to 60° Fahr.

It might have been possible to jacket the condenser more efficiently, and keep the temperature up for a longer time; but it was evident that nothing like a uniform temperature could be obtained at the outlet of the condenser without some external

means of varying the cooling effect of the condenser as the distillation of the charge progressed, and the amount of gas to be cooled, and especially of steam and tar to be condensed, diminished. The condenser was therefore altered to try to keep the gas at the inlet of the tar-separator at a more uniform temperature. In tests Nos. 5 and 6, the top bar of the condenser proper was provided with an external water-spray, and the lower part of the condenser disconnected; the gas passing as directly as possible from the top bar of the condenser to the tar-separator. This cut down the condensing system to about one-third of its former size, and diminished correspondingly the amount of time during which the gas remained in contact with the tar before the separator. The temperature at the inlet to the separator in tests Nos. 5 and 6, starting at 120° Fahr., dropped to 100° Fahr. in two hours, and then slowly to 80° Fahr. at the close of the test. The manner of condensing the gas in these two experiments then differed from the usual commercial practice, in that the gas was cooled more quickly and more completely than is customary in the gas-works.

The work performed by the condensers in the two tests is best studied in fig. 4. In the condensing system, the unit of comparison is usually a cubic foot of gas instead of the pound of coal; so that the total yield of tar and ammoniacal liquor is shown again calculated to a basis of cubic centimetres per cubic foot of gas, and below these charts the amounts separated by the condenser. It will be observed that practically all the water (an average for both tests of 93·5 per cent.) separates out in the condenser, and that a portion of the tar, varying rather irregularly from 18 to 50

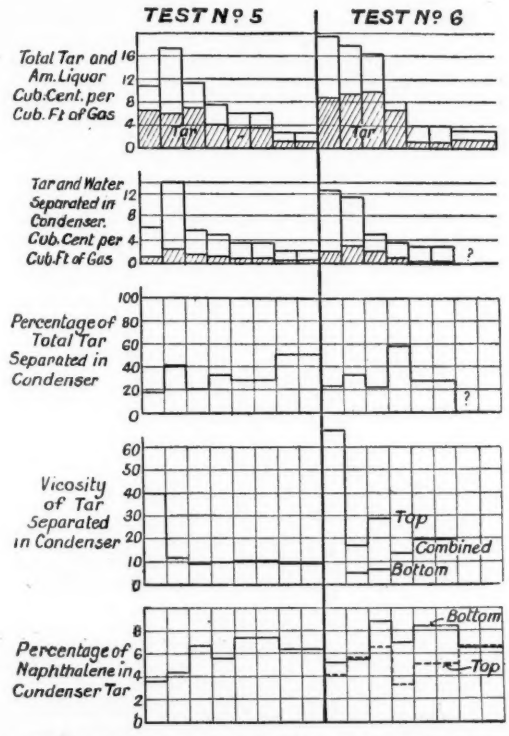

TEST Nº 5
TEST Nº 6
Total Tar and Am. Liquor Cub. Cent. per Cub. Ft of Gas
Tar
Tar
Tar and Water Separated in Condenser. Cub. Cent per Cub. Ft of Gas
Percentage of Total Tar Separated in Condenser
Vicosity of Tar Separated in Condenser
Top
Combined
Bottom
Bottom
Percentage of Naphthalene in Condenser Tar
Top

Fig. 4.—Data on Products from the Condenser by Half-Hourly Intervals.

per cent. of the total amount, and averaging about 30 per cent., is also separated there. The fine globules of water first formed apparently coalesce readily to form drops of sufficient size to settle out of the gas stream, and so the water is nearly completely removed. The tar, on the other hand, though at the temperature of the condenser it must be nearly as completely condensed to fine globules, resists the agglomerating process by which larger tar globules are formed, and hence settles out in a much smaller degree. We may surmise that it is because of the higher surface tension of the tar particles, but there is no absolute evidence of it; neither is there any clear reason why the condenser should be so irregular in its manner of removing the tar. In the hope that viscosity might offer some explanation, the viscosity of the tar separating from the condenser in the two experiments was determined. The Engler viscosimeter was used; and the temperature chosen was 110° Fahr., which would be about the average temperature of the gas leaving the condenser. The tests did not throw entire light on the question; but they did show a variation in viscosity during the test which was unexpected, and seems to be worth noting.

It had been expected that the first tar to come off would be the most fluid, and that with increasing temperature the tar would become more viscous. On the contrary, the very first tar flowing from the condenser was the most viscous of the series. The results are shown graphically in fig. 4; the ordinates being time required, in minutes, for 50 cubic centimetres of tar at 110° Fahr. to flow from the Engler viscosimeter. In test No. 5, the tars from the top and bottom drips of the condenser were combined to a single sample, the viscosity of which was determined—making only one curve for the condenser tar. In test No. 6, an attempt was made to differentiate between the tar from the top and bottom drips; but complete curves could not be obtained, because the samples were not always large enough for the tests. These are too few to be conclusive; but, on the whole, they indicate that the more viscous the tar, the less readily it is removed in the condenser. This is an unexpected result which requires confirmation. There has not been time to investigate the cause of the very high viscosity of the tar of the first period; but we hope to take it up later.

Work of the Tar-Separator.

It was desired to make a careful test of the action of the Pelouze and Audouin tar-separator. Ordinarily, in works practice, the separator is filled with tar to the level of the overflow, and the tar as separated displaces an equivalent amount which runs out of the overflow. We desired to know not only the amount of tar separated during each period, but also its quality; and we necessarily adopted a different procedure. At the beginning of a test, the separator was filled with ammoniacal liquor drawn from the works, and at the end of each period the drip-cock at the very bottom of the separator was opened cautiously, and the tar, with a small amount of liquor, was drawn off. More ammoniacal liquor was then run into the separator to replace the volume of the tar and liquor drawn off, so that the level of liquor was kept constant throughout the test.

The gas came to the tar-separator at a temperature varying from 115° Fahr. in the early part of a test to 80° Fahr. at the end. In its passage through the condenser, an average of 93·5 per cent. of the condensable water had separated out; leaving 6·5 per cent. of water-mist entering the separator. Our figures do not show that any appreciable amount of this residue was separated in the Pelouze and Audouin apparatus. Some of our tests even show an apparent slight increase in this suspended water at the outlet, due either to faulty sampling or possibly to some splashing in the interior of the separator. If the temperature of the gas entering had been hotter, there would undoubtedly have been condensation of water in the separator; but so far as we can determine, the amount of suspended water at the outlet of the separator was in our case the same as at the inlet.

The next point to be considered is the removal of tar by the separator. It may be remembered that in a paper read before the Association a year ago,* we recalled attention to the difficulties of getting a fair sample of the crude gas, owing to the non-uniformity of distribution of the tar particles in the cross section of the main. In a recent paper read before the Manchester District Institution of Gas Engineers, Messrs. Clayton and Skirrow have discussed this question, and laid down directions for sampling which they believe ensure accuracy.† They draw their samples from a point one-third of the diameter from the side of the main, which they say is the point of average velocity. The theoretical point for mean velocity in a perfectly smooth pipe free from curves is, however, distant from the centre of the pipe by a space about two-thirds of the radius of the pipe instead of one-third, as Messrs. Clayton and Skirrow have placed it. Furthermore, as Threlfall has demonstrated by his careful experimental study, practical conditions are very different from the theoretical. His experiments show that the radius of mean velocity varies from 0·72 to 0·84 of the radius of the pipe, according to the velocity of the gas stream and the size of the pipe. In one case of a 16-inch main examined at a distance of 30 feet from the nearest bend, the radius of mean velocity was 0·9 the radius of the pipe. Threlfall's own conclusions are that the point of mean velocity of the gas must be determined experimentally in every case. It is probable that Messrs. Clayton and Skirrow's figures on the efficiency of various types of tar-separators are reasonably accurate, for, as we said of our own tests last year, "the results" (of tests conducted as ours were) "on the amount of tar coming to and leaving the Pelouze and Audouin separator are roughly comparable with one another on account of agreement in the method of sampling employed, but do not necessarily represent a fair average of the conditions prevailing in a gas-main." It does not seem possible, with a simple sampling device, to determine very accurately the suspended tar in gas-mains, particularly when there is a large amount of such tar present.

Table IV.—*Elimination of Tar by the Separator.*

Half-Hour Periods.	Test No. 5. Aver. Temp. Inlet of P. & A. Deg. Fahr.	Test No. 5. Tar Removed, Per Cent.	Test No. 6. Aver. Temp. Inlet of P. & A. Deg. Fahr.	Test No. 6. Tar Removed, Per Cent.
1	106	93·7	115	98·7
2	113	94·1	114	98·6
3	109	96·5	113	96·7
4	102	92·5	105	97·8
5, 6	94	92·0	95	94·5
7, 8	84	84·5	84	96·5

Fortunately in the tests reported here we are not compelled to trust to the accuracy of indirect methods to determine the amount of tar separated by the Pelouze and Audouin apparatus, for we have the direct volume of tar separated in each period. The only point upon which there may be doubt is the exact weight of the small amount of tar left in the gas at the outlet to the separator. But this amount is so small that even a consider-

* See "Journal," Vol. XCVI., pp. 181, 244, 324.
† *Ibid.*, Vol. XCVIII., p. 660.

able percentage error would not seriously affect the calculation of the percentage elimination of tar in the separator; so that the figures on the elimination of tar are believed to be worthy of every confidence. The amount of tar eliminated, figured in cubic centimetres per cubic foot of gas, is shown graphically in fig. 5; and the percentage elimination is given in Table IV.

The average percentage elimination for test No. 5 is 92·2, and for No. 6, 97·1. The elimination in No. 6 is superior to No. 5. The external conditions—such as management of condensing system, temperature at inlet of separator, differential pressure, &c.—being nearly the same, we are driven for a possible explanation to ascribe it to the difference in the properties of the two tars due to varying conditions in the retort resulting from the widely different weights of coal charged. The viscosities of the tars drawn from the tar-separator have been determined, and are shown graphically in fig. 5. As was the case with the condenser tars, the

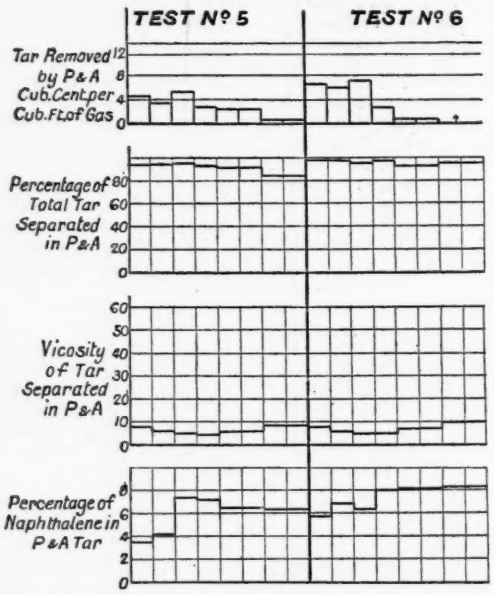


Fig. 5.—Data on Products from the Pelouze and Audouin Tar-Separator by Half-Hourly Intervals.

viscosity was determined at 110° Fahr., and the results indicate the time in minutes required for 50 cubic centimetres of tar to flow from the Engler viscosimeter. The figures on viscosity are given in the following table:—

TABLE V.—*Viscosity of Tars from the Separator.*

Half-Hour Periods.	Test No. 5.	Test No. 6.
1	7·7	8·0
2	6·0	6·2
3	5·0	5 3
4	4·9	5·0
5, 6	5·1	7·0
7, 8	8·2	9·7

These tars again show a relatively viscous tar at the first of the run—the viscosity diminishing to the middle, and increasing at the end. But there is no apparent connection between this viscosity and elimination of tar by the separator. A large number of tar distillations have also been made, in an effort to account for their different behaviour; but no definite conclusions are yet discernible.

THE ELIMINATION OF NAPHTHALENE.

Test No. 5 showed very little naphthalene in the gas at the outlet of the tar-separator, except in one period—the third half hour—when, as noted before, the production of naphthalene was exceedingly high. The tar did its best to take care of the excess of naphthalene; the percentage of the latter in the tar drawn from the separator jumping from 4·2 per cent. in the second half hour to 7·4 per cent. in the third. But it could not take care of it all, and the gas left the separator containing 0·009 gramme of naphthalene per cubic foot, which would correspond to a saturation temperature of 49° Fahr. This is only a small quantity of naphthalene, and would not have caused trouble ordinarily in a gas-works. In test No. 6, a small but fairly constant amount of naphthalene was present in each test, corresponding to a saturation temperature of 33° to 37° Fahr. This again was too little naphthalene to cause any trouble. Practically all the naphthalene had been dissolved out by the tar.

It may be interesting now to trace the removal of naphthalene by the tar. In test No. 5, each lot of condenser and separator tar was analyzed for naphthalene; and in test No. 6 a still further differentiation was made of the condenser tar—that from the upper and hotter part of the condenser being tested separately from that depositing during and after the water cooling. The various analyses are shown graphically in figs. 4 and 5; and it will be sufficient to present here the average results.

TABLE VI.—*Elimination of Tar and Naphthalene.*

	Test No. 5. Total Tar Separated. Per Cent.	Test No. 5. Composition of Tar. Percentage of Naphthalene.	Test No. 6. Total Tar Separated. Per Cent.	Test No. 6. Composition of Tar. Percentage of Naphthalene.
Upper condenser	17·1	5·8	13·7	5·4
Lower condenser	11·8		12·6	6·9
P. & A. separator	65·0	5·9	72·4	7·3
Tar passing P. & A.	6·1	—	1·3	—
	100·0		100·0	

The tars separated at the higher temperature of the upper part of the condenser contain less than 6 per cent. of naphthalene. In test No. 5, the total naphthalene was so low that the tar could dissolve it all without the naphthalene being over this figure. In test No. 6, on the other hand, the tar in taking out all the naphthalene had to absorb as high as 7·3 per cent. of its weight. There is no evidence to show whether or not it could have taken up more had it been given an opportunity. At the beginning of the paper it was shown that the amount of naphthalene formed per pound of coal was 70 per cent. greater in test No. 6 than in No. 5, while the tar was only about 40 per cent. greater. Nevertheless this tar was able to dissolve the increased naphthalene so completely as to leave only a harmless trace remaining in the gas at the outlet of the separator.

WORK OF THE TAR-WASHER AND THE SCRUBBER.

We have not studied the action of the tar-washer and scrubber nearly so completely as that of the condenser and the tar-separator. This was partly because at the beginning of the work we did not desire to make the tests any more complicated than they already were, and partly because of the difficulty of getting direct measurement of the action of these pieces of apparatus. The quantity of tar separated in them is so small that the amount remaining sticking to the various interior surfaces of the apparatus is disproportionately large, and hence only a small portion of the tar separated appears at the drips to be measured. In continuous operation, the surfaces would eventually all become coated, and the difficulty would disappear; but it has not seemed practicable to make a detailed study of their action on a single four-hour charge. The purifier had not been connected at the time of these tests, and the only tests made were for tar and naphthalene at the inlet to the meter. In test No. 6, where only 1·3 per cent. of the tar passed the separator, nearly as much was found after the gas had passed the washer and tower scrubber and had reached the meter. In test No. 5, where 6·1 per cent. of tar passed the separator, there was more opportunity for the tar-washer and tower scrubber, and they together removed about 75 per cent. of the remaining suspended tar; so that the gas came to the meter inlet in test No. 5 with about the same amount of suspended tar that was present in No. 6. In test No. 5, too, appeared the effect of the ammoniacal liquor upon the phenols of the tar separated in the washer and scrubber, setting free naphthalene which appeared in the gas.* Though in three out of the four tests made in test No. 5 at the outlet of the tar-separator no measurable amount of naphthalene could be found in the gas, every test at the inlet to the meter showed it to be in measurable amount. This naphthalene at the inlet to the meter must have been liberated from the tar in the washer or the scrubber.

SUMMARY.

The present paper, besides describing the experimental plant, gives detailed data of two tests on the same lot of coal, carbonized in the same retort for a four-hour period at temperatures approximately the same. The difference between the two tests lies in the weight of coal charged; in test No. 5 a heavy charge of 470 lbs., and in No. 6 a light charge of 350 lbs. being put into the retort.

With light charging, the yield was 1520 cubic feet of gas, 0·4 gallon of tar, and 0·6 lb. of ammonia more per ton of coal than was obtained with heavy charging; this being offset in part by a decrease of 112 lbs. of coke per ton. The amount of naphthalene formed per ton of coal was 1¾ times as great with the light charge as with the heavy one; but in the tests as here reported the tar was capable of taking care of all the naphthalene, and no amount that could give trouble remained with the gas. The progress of the carbonization in the retort and of the action of the condensing system is traced by half-hour intervals.

It is not claimed that any general conclusion can be drawn from these tests; but they are presented as an interesting illustration of the differences which may arise. The great number of variables which enter into experiments of this sort make it almost impossible to decide what phenomena are produced by purely local and incidental conditions, and what results are typical and may always be expected to appear with given conditions. By a compilation of a large number of tests of this sort in which all possible data are recorded, the influence of the type variables will eventually be distinguishable, and then generalizations may be drawn. This difficulty in accounting for different results has made us refrain from burdening your proceedings with unintelligible data of many other tests made by ourselves. It is still more difficult to intelligibly compare the results of our tests with those of other experimenters, where every experimental factor differed

* See paper on "The Removal of Naphthalene from Coal Gas," by A. H. White and D. H. Cleary, in "JOURNAL," Vol. XCII., pp. 365, 388, 466.

from our own. We have, therefore, refrained from citing the work of preceding experimenters—leaving such comparison till we may have amassed more data of our own. It may be possible for men whose duty makes it necessary for them to daily puzzle over such obscure factors, to state how far various phenomena here noted may be general and how far they are accidental. We leave the discussion in their expert hands.

DIFFUSION PHENOMENA IN FLAMES.

By R. Casaubon.

[A Paper submitted at the Congress of the Société Technique.]

(*Continued from p.* 38.)

In the case of a gas-flame without any separate air supply, the insertion of the cerium mantle gives an outline on the mantle, which shows at the base a portion where the original colour of the mantle remains unaltered. Then comes a yellow region; afterwards a red portion; and finally a white aureole surrounding the whole. At the end of a few seconds, the deposition of carbon is seen to take place in the lower part; and a few minutes later a similar phenomenon occurs in the upper portion. These two deposits, however, are not of the same kind. The first, which takes place almost instantaneously, is due to the deposition of the benzol by the oxide of cerium in the portions between the temperatures of 150° and 700° C. It is of uniform tint and regular outline. The upper deposit, however, is formed from particles of carbon held in suspension in the flame, which the rough surface of the mantle attracts in their passage. It forms slowly, and being the result of mechanical action, it is greater at some points than at others. It is irregular and of different colours. In a flame of hydrogen rendered luminous by ethylene, only the upper deposit forms. This fact makes it easy to recognize whether an illuminating gas owes its luminosity solely to ethylene.

Regarding the temperatures at different points of the flame observed (as above explained) by the luminous appearance of the mantle, the red zone should be sharply distinguished from the white zone which surrounds it. In the first, the temperatures increase regularly, and the curves of equal temperature can be roughly defined by saying that they are homothletics of the outlines of the lower deposit of carbon in reference to the centre of the delivery aperture. In the white zone, the maximum temperature occurs at the base of the flame, and falls progressively towards the apex. On the other hand, this white zone increases in size in the upper portion; and to this fact must be attributed the results obtained by certain investigators, who, by means of the thermo-electric couple, have found the maximum temperature to be at the apex of the flame. The couple is so fine that it should not be entirely immersed in the hot zone at the base of the flame—its thickness does not permit of it. It can, however, be completely immersed at the apex, and brought into equilibrium with the temperature of the hot gases which circulate rapidly at this point.

The brightness of the thin band which is visible at the base of the flame is equal to, if not greater than, that obtained in the hottest zone of a flame supplied with air—that is to say, in the metallic gauze. It is consequently not correct to say that a gas mixed with a primary air supply gives a hotter flame than one unmixed burnt in the air. This statement, however, is true only when the temperature of a flame is defined as its mean temperature. If, however, one is speaking of the maximum temperature obtained at one point, the mixture of air and gas has no special advantage.

Coming now to the flame of a mixture of air and gas, the gradual admission of air to the gas leads to the reduction in height of the internal zone, while the white aureole increases to a corresponding extent. The upper deposition of carbon forms more and more slowly, and ceases completely when the proportion of air reaches 100 per cent. A particularly noteworthy phenomenon is visible with the emission of the primary air. It is the appearance in the interior of the flame of a white line, giving evidence of the existence of an oxidizing zone in a reducing region. The fact is of importance; and it was therefore necessary to ascertain that this white line on the cerium mantle actually was an oxidizing zone. For this purpose the flame was lowered, and the white line was thus brought in contact with the deposit of carbon previously formed on the mantle. The carbon instantly disappeared on contact with the narrow white region. A further confirmation of its character was obtained by substituting metallic gauze for the tissue of cerium. It was found that at the end of a few minutes the oxidizing lime left evidence of its character by a yellow deposit, due to the peroxide of iron. The same phenomenon occurs whatever kind of gas may be burnt. It has been observed in the case of pure hydrogen and carbon monoxide.

This white line, which takes the form of a curve of equal temperature, mixes with the green zone which characterizes the interior of a flame when the proportion of primary air is sufficient. It is the region of the points where the temperature has become sufficient to effect the combination of the oxygen and the combustible gas. It can therefore be affirmed, in opposition to certain accepted opinions, that there is no such thing as a reducing combustion. Every form of combustion is oxidizing; the products of combustion alone are oxidizing or reducing according to the proportion of air admitted.

It is moreover very difficult to explain how combustion can be an oxidizing process in cases when the gases liberated are themselves absorbent of oxygen. But the fact itself admits of no question. The oxidizing action shows itself, however small may be the proportion of air admitted; and this phenomenon can be utilized to identify with facility traces of oxygen in a gas. For this purpose a deposit of carbon is produced upon a cerium mantle, and the flame is then slowly lowered in order to reduce its height by one-half. If the deposit of carbon is not altered, the gas does not contain oxygen; if it disappears at its upper portion, oxygen is present. The process is sufficiently sensitive to detect 1 part of oxygen in 500 parts of gas.

Passing now to the consideration of a combustible gas when the proportion of primary air in admixture with it approximates to that necessary for complete combustion, the white line above referred to is lowered to the metallic gauze enclosing the burner. Above it there is visible a blue flame which appears uniform throughout. This flame gives rise to two hypotheses: (1) The oxygen and the combustible gas require a certain time to combine, the height of the flame measuring the time necessary for this reaction; or (2) the reaction is complete at the outlet of the burner, but the products are partially dissociated. In proportion as they rise, they tend to cool, first by radiation and afterwards by diffusion into them of the air. The dissociated gases, by their gradual re-combination, oppose this cooling action to such an extent that the action of the latter is appreciable only when there are none of these gases. According to this hypothesis the volume of the flame would represent the region in which the dissociated gases are re-combining.

To choose between the two hypotheses, the flame was cooled by admitting with each volume of combustible gas an excess of air. If the first hypothesis be correct, the flame should increase in height, primarily because the speed of the current increases, and secondarily because the rapidity of the reaction is diminished by the dilution. If, on the other hand, the second hypothesis be true, the flame should decrease in height, since the coefficient of dissociation will be lessened by the presence of air taking no part in the combustion. It was found by experiment that the second hypothesis was confirmed. This result can be further checked as follows: If, instead of cooling the flame with an excess of primary air, the proportion of the latter is kept the same, and the flame is protected from cooling by enclosing it in a vessel which prevents any access of air, it is found that the flame becomes much higher than when in the free air. These two concordant experiments prove that the visible flame of an exactly adjusted combustible mixture is the region where the dissociated elements re-combine.

A Diffusion Theory of Flames.

It is possible from these observations to form an idea of the constitution of flames by attributing an important part therein to diffusion phenomena. To begin with, it is easy to prove that in the internal zones of the flame there is a penetration, by diffusion, of the carbon monoxide and carbon dioxide, which are formed from the exterior layers in combustion, and not from incomplete combustion. An illuminating gas subjected to analysis gives the following results:—

Carbon dioxide	1·3 per cent.
Oxygen	— ,,
Carbon monoxide	8·6 ,,

The same gas was ignited at the outlet of a tube 18 mm. in diameter, and a sample taken in the region of the flame which was shown by the deposit of carbon to be at a temperature of less than 150° C. In this portion no combustion, either complete or incomplete, nor any decomposition by heat, had taken place. The analysis gave—

Carbon dioxide	3·5 per cent.
Oxygen	— ,,
Carbon monoxide	12·8 ,,

An increase in the proportion of carbon monoxide and carbon dioxide can, it thus appears, only proceed from the external zones in combustion.

This being so, let us consider a simple disc of the flame as it leaves the outlet of the burner; its external section being immediately penetrated by the air entering into combustion. The products of combustion penetrate, as we have seen, by diffusion into the central portion of the disc, carrying with them a certain quantity of heat, and displacing a corresponding volume of combustible gases. During this time, combustion continues at the section of the disc. The phenomenon proceeds in a continuous manner up to the moment when all the combustible gases displaced by the products of combustion burn at the section of the disc, whatever may be the deformations to which this latter is subjected in the course of the passage. It results from this hypothesis that there is no need to consider zones of combustion, complete or incomplete, accession of air, &c. In a flame, only the external envelope indicated on the cerium mantle by a white aureole would be the seat of combustion. The central portion would be heated only by the burnt gases which penetrate it by diffusion, and which gradually displace the combustible gases. All this happens, in short, as if the external atmosphere penetrated the flame according to the laws already stated for a vertical jet of gas. But in traversing the zone of combustion the air becomes converted into aqueous vapour and carbon dioxide. This change evidently alters the coefficients, but leaves unaltered the laws established in connection with the process.

If the hypothesis be true, it should be possible to apply the laws already enunciated in reference to diffusion. In all that relates to the latter, they should be capable of application without taking account of the differences of speed, so long as the experiment is carried out within ordinary convenient limits. In short, the narrow gaseous streams in the periphery of the flame are richer in hot diffused gases than those within the flame. As a result, their lesser density tends to increase their speed, while friction tends to diminish it. There is thus set up between these two actions a compensating approximative condition which allows the speeds to be considered, from the point of view of diffusion phenomena, as practically equal in all parts.

Therefore, if the hypothesis is correct, it should be possible to confirm the following propositions.

(1) The heights to which the different phenomena apparent on the axis of a flame will rise for different speeds of current will be proportional to these speeds. Two points are sharply visible along the axis of the flame—one being the end of the carbon deposit, and the other the apex of the red internal zone. Experiment gives the following figures:—

Consumption in Litres per Minute.	Height of Carbon Deposit in Millimetres.	Consumption in Litres per Minute.	Height of Reducing Zone in Millimetres.
0·374 ..	3	0·058 ..	5
0·499 ..	8	0·110 ..	10
0·980 ..	17	0·150 ..	15
1·400 ..	25	0·210 ..	20
1·800 ..	31	0·280 ..	25
2·410 ..	42	0·320 ..	30
		0·370 ..	35
		0·430 ..	40
		0·480 ..	45
		0·520 ..	50

These figures give the lines: O X (fig. 1) and O Y (fig. 2)

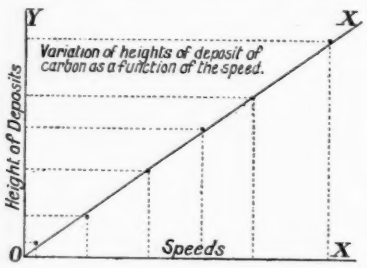


Fig. 1.

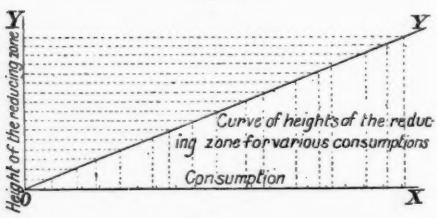


Fig. 2.

from which it will be seen that the heights of the carbon and of the reducing zone are proportional to the speeds of gas.

(2) If a certain proportion of primary air is admitted with the gas, there is still less to diffuse from the outside air before complete combustion is reached. As a result, for a constant consumption of pure gas, the hight of the red zone should diminish proportionately to the volume of primary air admitted. On this point, the following results were obtained with a consumption of gas of 0·85 litre per minute:—

Proportion of Primary Air. Per Cent.	Height of Reducing Zone. Millimetres.	Proportion of Primary Air. Per Cent.	Height of Reducing Zone. Millimetres.
0 ..	80	282·5 ..	37
12·5 ..	79	320·0 ..	32
40·0 ..	74	338·0 ..	30
52·5 ..	72	385·0 ..	25
85·0 ..	68	405·0 ..	21
107·5 ..	64	455·0 ..	15
150·0 ..	57	485 0 ..	8
205·0 ..	48	525·0 ..	2

These figures are shown graphically by the line X X (in fig. 3).

(3) The curves of equal temperature should be represented by parabolas having their apex at the edge of the outlet aperture. This curve cannot be drawn with absolute accuracy, as the speeds at different points are not equal, and as, further, the surface of the mantle is not perfectly flat. Nevertheless, one can easily see that the parabolic occurs in the deposits of carbon on the photographic reproduction (fig. 4).

(4) For the same consumption, the heights to which the different phenomena are produced along the axis are independent of the diameter of the outlet aperture. The following results were obtained:—

Diameter.	Consumption.	Height of Red Zone.	Height of Carbon Deposit.
18 ..	0·48 ..	45 ..	7
14 ..	0·48 ..	45 ..	7

In the case of combustion without a separate air supply, the heights of the flame coincide practically with those of the reducing zone; and one can therefore state the following approximate rule: For a constant consumption, the heights of the flame are independent of the outlet aperture.

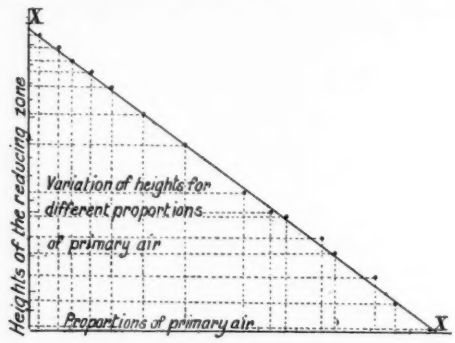

X
Heights of the reducing zone
Variation of heights for different proportions of primary air
Proportions of primary air.
X

Fig. 3.

The hypothesis which has been suggested therefore appears to be confirmed; and it furnishes, moreover, easy explanations of the observed phenomena. It has been seen, for example, that in the red zone the temperature rises progressively, following the regular curves; while in the oxidizing zone the maximum occurs at the base of the flame. These facts are easily explained if one assumes that in the red zone the temperature rises simply by a division of the heat of the diffused gases which penetrate it. The white aureole, on the other hand, is the seat of combustion proper. Pure gas burns at the base of the flame, at one point at least with the exact proportion of air necessary; but in proportion as it rises, the gases which have undergone combustion in the external zone are more and more charged with inert gas. It is true that these latter may themselves have come to a high temperature. But they have had time during their passage to cool somewhat by radiation; and in every case they increase by dilution the time of the reaction, and consequently reduce the temperature.

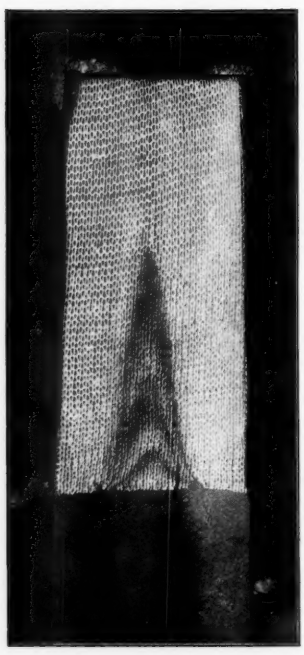


Fig. 4.—Photograph Showing the Lower Carbon Deposits Obtained at Three Varying Speeds.

It may be remarked that if different gases of fairly similar composition—such that the variations in the coefficient of diffusion are negligible—are burnt in the same burner, the heights of the flame for the same consumption will be in direct linear relation with the volume of air necessary for their complete combustion. These conditions will be practically realized for the usual illuminating gases; and the calorific power being itself in direct linear proportion with the volume of air necessary for complete combustion, it results that a jet of flame the supply of gas to which is kept absolutely constant forms a more exact calorimeter than it does a photometer.

(To be concluded.)

Mr. Robert Dempster, of Manchester, has taken Lord Delamere's Cheshire seat, Vale Royal Abbey, and the shooting for a term of years.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

Annual Meeting and Presidential Address.

The session of the Scottish Junior Gas Association was opened on Saturday afternoon by the holding of the annual meeting of the Eastern District, in the Heriot-Watt College, Edinburgh. Mr. W. BROWN, of Lasswade, occupied the chair.

The PRESIDENT said that in his opening remarks on taking up the duties of President he expressed the desire that the session might be as successful as its predecessors; and he thought he could, with confidence, say that his desire had been fully gratified. The papers read had been of an exceptionally high order, and the discussions on them left nothing to be desired. The visits of the Association to works had all been well attended, and had been appreciated. He thought he was safe in saying that the Association was in a better position than it was a year ago. He hoped this result might be an incentive to the members to strive after doing better things in the future. They ought to feel gratified that the Senior Association continued to take such an interest in them. The syllabus for the coming session had been drawn up; and it was an excellent one. He understood that papers had been promised for every meeting; and it said much for the ability and energy displayed by the Hon. Secretary (Mr. J. R. Moyes) that they found themselves in such a position.

The financial statement submitted showed that the income for the year was £24, and that there was a balance of £1 7s., which was considered to be satisfactory.

The PRESIDENT, on vacating the chair, thanked the members for the kindly way in which they had acted towards him in his endeavours to carry out the duties of his office. If he had caused offence to anyone, he asked to be forgiven. To Mr. Moyes, to members of the Committee, and to the Press, he tendered his sincere thanks for the advice and help he had at all times received at their hands. He thought he was quite safe in saying that the Hon. Secretary was the hardest-worked man in the Association. They were deeply indebted to Principal Laurie, of the Heriot-Watt College, for so kindly placing at their disposal the use of the College for holding their meetings. He had much pleasure in introducing his successor—Mr. D. Bisset, of Granton—and he was sure, from what he knew of him, that the affairs of the Association would not lose anything in his hands.

Mr. Bisset, having taken the chair, as his first duty presented Mr. Brown with a gold pendant, as a memento of his year of office.

Mr. BROWN briefly acknowledged the gift.

ELECTION OF OFFICE-BEARERS.

The following were elected office-bearers for the year:—

President.—Mr. D. Bisset, of Granton.
Vice-President.—Mr. A. Morton Fyffe, of Dundee.
Hon. Secretary and Treasurer.—Mr. John R. Moyes, of Edinburgh.
Members of Council.—Messrs. H. Gourlay, of East Wemyss; J. Dickson, of Kelty; J. T. A. Taylor, of Granton; G. Alexander, of Granton; J. Davie, of Edinburgh; and W. Williamson, of Leven.
Auditors.—Messrs. J. Davie and J. G. Farquhar, of Edinburgh.

THE PRESIDENTIAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address, in the course of which he said:

It is with much hesitation that I accept the honour you have conferred upon me by placing me in the chair. When our former Secretary, Mr. Rule, told me, a year ago, that you had chosen me as Vice-President, I had at first the mind to decline it. On reconsideration, however, I thought it to be my duty to accept it. During the three years of the Association's existence, we have been specially fortunate in having able and enthusiastic Presidents. I trust that during my tenure of office the interests of the Association will in nowise suffer. I have to tender you my best thanks for electing me to this chair; and I feel sure that your ready assistance will render my position an easy one.

One of the greatest troubles a President can have is finding what to speak about in his presidential address. So much has been said and written in the past on matters pertaining to our own industry, that it is difficult to say anything new. With your permission I propose making a few observations taken from a bird's-eye view of the gas industry as it strikes me at the present time. Since the time of Murdoch and Clegg in this country, and Lebon in France, "much water has passed under the bridge." From about the year 1800, when gas for lighting was first made, the industry has gone up by leaps and bounds; and during the last ten years especially, in spite of the determined opposition of rivals, it still forges ahead. Instead of saying in spite of opposition, it might be more correct to say because of the determined opposition; for healthy rivalry will do the trade no harm, but, on the contrary, should spur it on to greater achievements. We have a splendid illustration of this in our own neighbourhood. In Mid and West Lothian, the business of shale mining, carbonizing the shale and refining the oils, and the manufacture of sulphate of ammonia, has been carried on for a long period in an extensive way. The trade has had a very chequered history, with many ups and downs. At one time, owing to the large importation of American and Russian petroleum oils, it was thought that the Scottish shale oil industry would be completely wiped out of existence. It was then a question of fighting for their very life. Put upon their mettle, under the guidance of men like Mr. N. M. Henderson, of Broxburn, Mr. George Beilby, of Oakbank, the late Mr. William Young, of Peebles, and others, investigations and experiments were carried on. The outcome was that the methods of mining and retorting the shale, and the refining of the oils, were so perfected, and the yields of ammonia so increased, that to-day the Scottish shale oil industry is on a more secure footing than ever it has been in its history. All that human skill, thought, perseverance, and ingenuity could do was done, and with splendid results.

Although the gas industry is now in a flourishing condition, we cannot afford to look lightly on the strenuous opposition brought forward by electricity, producer gas, &c. "Eternal vigilance must be the price of our freedom." The strong opposition from electricity has much benefited gas, by making it improve upon its methods of production and distribution, and finally showing the consumer how to use it to the best advantage. Evolution is slowly but surely working great changes. Of all the changes and improvements that have been made in the consumption of gas, the most important by far is the inventing and the perfecting of the incandescent mantle and burner. Nowadays the people demand light, and plenty of it. Compared with the ordinary flat-flame burner, we get at least seven times the lighting efficiency from the incandescent burner. No wonder the flat-flame burner is getting to be looked on as a curiosity. Not only has the incandescent gas-burner made great progress for indoor lighting, but also for street lighting as well. The popular cry used to be for the glaring electric arc lamp for streets; but gas is holding its own there. Certain areas in London (streets and bridges) which used to be lit with electricity, are now lighted with gas. The authorities have found the light better and much more economical than the electric arc lamp.

Interesting experiments in the lighting of railway carriages with gas are being carried out by some of the Scottish Railway Companies; and a visit to the Waverley Station will amply repay any member for his trouble. He will find each railway carriage compartment lit up like noonday with a single incandescent burner, replacing the usual cluster of four electric carbon filament lamps. On the French railways gas has been used for lighting the carriages for some years past, with satisfactory results. Supporters of electricity argue that gas for lighting is more dangerous in the matter of causing fires than the former, especially in railway trains. This, however, is a mere assertion, and remains to be proved. It seems to be the other way about. The German Association of Fire Insurance Companies do not look upon electricity as being safer than gas. In answer to an inquiry as to whether they would give reduced insurance rates if gas was replaced by electricity, they replied "that under no circumstances could there be a reduction, but there might be an increase unless the installation was put up and maintained according to the regulations of the Fire Insurance Association." The "JOURNAL OF GAS LIGHTING" dated March 12 and also of April 30 last gave some interesting particulars as to the dangers incurred by the use of electricity in the City of London, and the suggestions and rules drawn up by the authorities and the Fire Insurance Companies. The safety claimed for electricity by its supporters seems to be non-existent; and, when all is said and done, gas is not such a sinner as its rival.

The introduction of the incandescent mantle has brought about a condition of things that renders it unnecessary and unwise to produce gas of so high an illuminating power as formerly. What was necessary for the flat-flame burner is quite unnecessary for the incandescent burner. In making this change from a higher to a lower value, gas authorities and companies have had to overcome a good deal of foolish prejudice. The result of the change is that gas-works managers are able to make use of the average quality of coal that lies to their hand, and save to a considerable extent the use of costly cannel coal. Some have advocated two separate systems of gas supply—one for ordinary lighting purposes and the other of a low-grade quality for heating and power purposes. So many objections can be raised to this proposal that it appears to be outside the range of practical politics. A middle course seems really to be the wisest—viz., to supply a gas of something like 14-candle power at as low a price as possible.

The present methods of carbonizing coal seem to be as near perfection as possible. Yet it is in the retort-house, perhaps, that we shall see the greatest changes in the not distant future. There is a feeling that the present methods extract the maximum yield of gas; but not with a minimum use of mechanical appliances and of labour. Thoughtful men are asking is it not possible to devise retorts or ovens (call them what you will) which will be able to take much larger charges of coal and at the same time extract the gas as well? Germany and France are to the forefront experimenting with retorts of a vertical character; and we have British engineers working at the same idea on different lines, as, for instance, the Settle-Padfield and the Woodall-Duckham processes. Time alone can tell what the final result will be. So many different points have to be taken into consideration in a matter of this sort—such as yield and quality of gas, yield and quality of products, practicability of working, life of plant, &c.

The change, when it comes, must necessarily be a gradual one, and the result of patient investigation and experiment.

During last session the members of this Association had the opportunity of inspecting the shale carbonizing plant of the Broxburn Oil Company, Limited. Everyone was struck with the simplicity and smoothness of the working of the vertical retorts, so far as the distillation of shale at a comparatively low temperature is concerned. In the "JOURNAL OF GAS LIGHTING" for Jan. 16 and 23, 1906, Mr. W. R. Herring, of Edinburgh, had a paper dealing with the nature and working of the average Scottish shale oil retort. He gave drawings and particulars of a shale retort which he considers to be better adapted for the production of illuminating gas from coal. He has collected much valuable information and data regarding the working of the retort, and the principles underlying the same. It will be noted that the author near the end of his paper foreshadows that by the use of this retort it might be advantageous to work it principally for liquid products—the gas being a secondary consideration. Mr. Herring has shown the unwisdom of investigators neglecting to take the Scottish shale retort into consideration before launching into their own schemes. When we consider that these shale retorts have for years carbonized many millions of tons of material with efficiency and economy, it is right that gas engineers should study their merits for themselves. It may also be noted that the late Mr. W. Young, in collaboration with Mr. Glover, brought out a vertical retort for the carbonization of coal, which is an adaptation of the shale retort.

No drastic changes have taken place in the modes of purification, except that lime as a purifying agent is gradually but surely being displaced by hydrated ferric oxide. By the judicious revivifying of the oxide *in situ*, the purifiers do not require to be opened or emptied nearly so often as with lime. Consequently one of the most disagreeable tasks in a gas-works is reduced to a minimum.

Next to the gas itself, managers must get the utmost value for all the bye-products. The working up of ammoniacal liquor by the gas-works themselves is extending, and where the throughput of coal is 5000 tons and over, it may be wise to do so. Distillers have often to pay very heavy carriage on liquor to their works. The carriage alone in many instances would give a fair profit to gas-works. There has sprung up during the last two years a demand for tar as a dust preventative on roads; and it is the duty of gas people to foster and encourage its use. Every gallon of it taken off the usual market has a tendency to keep up the price of all the make of tar. Ordinary green tar is perhaps hardly so suitable for roads as "boiled tar"—that is to say, with the ammoniacal liquor and crude naphtha distilled off. If the larger gas-works are in a position to distil off the water and naphtha, the resultant tar will be better suited for the use of public roadways.

During the past year, we have had many rumours, advertisements, and newspaper puffs, referring to a new article that was to supersede coal and coke. This article is "Coalite." Since then we have had a limited liability Company, with a large capital, formed to take over the process and work it. Very few particulars of the nature of the article, or how it is produced, can be gleaned, as everything is kept a state secret. To use a Scots saying, it has been a case of "muckle cry and little 'oo" so far. A statutory meeting of the Company was held a few weeks ago; but little or no information was given to the shareholders. "Coalite" seems to be coal carbonized at a comparatively low temperature, and about half of the usual quantity of gas distilled off. It is said to contain 12 to 13 per cent. of volatile matter, practically no sulphur, and gives off little or no smoke—in fact, the article is nothing else than the ordinary gas coke which used to be made in gas-works years ago, when heats were much lower, and when the yields of gas never exceeded 7000 to 8000 cubic feet. Gas engineers have been greatly interested in the matter from the first; but also very sceptical of its merits. If "Coalite" is produced as it is said to be, where could it be produced better than in a gas-works, where there are carbonizing plant and facilities for dealing with the gas produced, and also the bye-products? Their patent has never been published yet, so the public must wait with more patience before they are in a position to judge the scheme.

Whatever "Coalite" may do in the future, one thing it has done; and it is this: It has given the gas profession a good lesson in the way of making a *bonâ fide* attempt to supply a coke really fit for household consumption. Beyond screening it into various sizes, gas-works do nothing in the way of selecting the coke from special coals. If a house trade can be built up by providing a coke with a low percentage of ash, and not entirely denuded of its volatile matter, it might be wise for gas people to go in for it. Besides helping the coke market, it would tend to abate to a considerable extent the smoke nuisance in large centres. To show how our Continental friends nurse the sale of coke, the following is taken from a paper by M. Coze at a Gas Association meeting. M. Coze is referring to Rheims, and said: "These considerations have led us during the past twelve years to push the retail sale of coke. We supply it in straw paper bags sealed by a gummed label. The bags are strong enough to stand anything except rain. From 300 to 500 of these are sold to small shopkeepers every day. There is quite a trade, people go down to the small shop and make their way home with a bag of coke under each arm; and the quantity of coke disposed of by the works in this way was 151,660 bags in the year 1906." This most alluring picture of the citizens making their way homeward with a bag of coke under each arm is very interesting, but would hardly work in this country. At the same time, it lets us see what pains our friends in France take to cater for the wants of the public.

With these expressions, my remarks must now draw to a close. We are just commencing another session's work; and our Council have drawn up a programme of papers, discussions, and visits to different works. To those who have taken a regular part in the yearly programme of work, no doubt exists as to the great benefit derived from the Association. We have the members giving us of their experience in the way of papers; and the subsequent discussion resulting from the reading draws out a variety of opinion and ideas. As individuals, we are apt to look at matters from one point of view only, which, when discussed by a variety of minds, assumes a different aspect. Another great privilege we have as an Association is the opportunity we have during the session of visiting works. Gas-works, or works directly or indirectly connected with gas-works, are chosen; and we have to acknowledge the great kindness we have uniformly received. On every occasion the works have been freely thrown open for our inspection.

GENERAL BUSINESS.

Mr. H. GOURLAY (East Wemyss) moved that the Council be elected for three years, and that two members retire annually; the object of the motion being to secure that there should never be an entirely new Council, but that there should always be upon it members who were fully acquainted with the working of the Association.

Mr. H. RULE (Falkirk) suggested that the period be for two years, and that three members retire annually.

This suggestion was accepted by Mr. Gourlay, and was agreed to by the members.

The HON. SECRETARY read a communication which he had received from the Secretary of the Midland Junior Gas Association, asking support to a proposal that, in the examinations of the City and Guilds of London Institute, the subjects of "Gas Manufacture and Gas Distribution" should be separated. He said the Council were of opinion that they should not take any action in the matter, as they did not see how it affected them. The members would, however, judge for themselves.

Mr. RULE said they received a circular upon the subject from the same Association last year, but the Council resolved to do nothing upon it; and he thought they acted wisely. They could not have general knowledge upon the subject without being acquainted with the manufacture and distribution of gas; and both were required in medium-sized works.

The recommendation of the Council was agreed to.

The HON. SECRETARY also stated that the Council had had under consideration a communication in which it was suggested that the Junior Associations should endeavour to obtain some official recognition by the Senior Association. He explained that before they could be recognized the members would require to pass an examination, and the Association would have to pay a fee of 5s. The Council thought it was not in their interest to put any obstacle in the way of young men becoming members of the Junior Associations; and they proposed that the matter of passing an examination should lie on the table.

The recommendation of the Council was adopted.

An invitation to attend a meeting of various Gas Associations, to be held in Manchester under the auspices of the Manchester District Institution of Gas Engineers, was submitted; and it was resolved not to accept it.

This concluded the business.

APPLICATIONS FOR LETTERS PATENT.

21,446A/06.—HOWARD, R. L. & E., LLOYD, R. S., HOWARD, H. F., F. E., & G. M., "Meters." Sept. 27.

21,071.—PRICE, H. A., and TURNER, H. C., "Gas-heated steam radiators." Sept. 23.

21,078.—RIDER, C. H., "Manufacturing fuel gas from mineral carbonates and carbonaceous materials." Sept. 23.

21,124.—MARCONNET, G., "Gas-producing apparatus." Sept. 23.

21,132.—PATERSON, R. O., "Coal-gas plant." Sept. 24.

21,139.—KENNEDY, R., "Gas-producers." Sept. 24.

21,146.—PARNHAM, A. E., and ROBINSON, J. H., "Prepayment meters." Sept. 24.

21,165.—ROBINSON, G. H., "Coin-freed meters." Sept. 24.

21,186.—GUNNING, J., "Gas-lanterns." Sept. 24.

21,212.—M'KEE, G. W., "Meter connections." Sept. 24.

21,315.—LINES, A., "Material for withstanding sudden and extreme variations of temperature, as required in mantle rings, nozzles for bunsen burners, &c." Sept. 26.

21,338.—KENNEDY, R., "Gas-producers." Sept. 26.

21,341.—BIRMINGHAM LAMP AND GAS-FITTINGS COMPANY, LTD., and DAVIES, A. E., "Globe holder for inverted lights." Sept. 26.

21,346.—PETERSEN, H., "Packing material for purifiers." Sept. 26.

21,384.—BUTLER, H. B., "Pressure-regulators." Sept. 26.

21,400.—ANDERSON, D., "Self-intensifying gas-lamps." Sept. 26.

21,427.—WELSH, W., and DUFFY, J., "Distilling tar." Sept. 27.

21,466.—YATES, A., and KERSHAW, J., "Suction gas plant." Sept. 27.

21,491.—ARMSTRONG, J., "Suction gas producers." Sept. 27.

21,503.—MINNETT, H. T., "Gas heating-stoves." Sept. 27.

21,515.—RILEY, E. C., and SLATTER, D. G., "Internal ladder mast for spiral guided gasholders." Sept. 28.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

The Ninth Annual General Meeting of the Association was held on Saturday at the Exchange Hotel, Manchester. At the outset, the retiring President, Mr. R. H. GINMAN, presided over a large attendance.

The HON. SECRETARY (Mr. A. L. Holton) submitted the annual report. He said there had been 16 new members elected, while 11 retired or resigned. The total membership was 116.

The HON. TREASURER (Mr. R. H. Garlick) presented the balance-sheet, showing cash in hand £2 7s. 1d., and bank balance £20 0s. 9d. The balance-sheet was unanimously adopted.

A revised set of rules was submitted to the meeting and discussed *seriatim*. Slight alterations were made in one or two of them. The annual general meeting will in future be held in April. The Council and officers elected at the present meeting will hold office until March 31, 1909. Ten days' notice is to be given in future of all meetings, instead of seven as heretofore. The new rules, as revised, were unanimously adopted.

The ballot for the election of officers was then taken, with the following result:—

Junior Vice-President.—Mr. J. Taylor, Hollinwood.
Auditors.—Mr. C. Berry and Mr. J. Robinson.
Members of Council.—Messrs. F. Thorp, D. V. Hollingworth, J. E. Dudley, J. Alsop, F. Oldfield, R. Braddock, E. Teasdale, and C. Woodhead. Mr. R. H. Ginman, according to rule, becomes Senior Vice-President.

Mr. H. DAVIES moved a vote of thanks to the retiring President and past members of the Council for their services during the year. They had all, he said, done good work.

Mr. F. HODGSON seconded the motion, which was carried unanimously.

Mr. GINMAN, in reply, said he had tried to do what he could to maintain the dignity and good work of the Association, and was pleased that the annual report was so favourable. He was glad to receive their approbation.

Mr. F. THORP replied on behalf of the Council. Some good work, he thought, had been done; and the new rules, too, would, if carried out, tend to strengthen the Association.

The PRESIDENT then moved a special vote of thanks to the Secretary and Treasurer, which was carried; and both officers replied.

Mr. E. T. WELLENS, of Hebden Bridge, the new President, was then conducted to the chair amid great applause, and proceeded with his address, in the course of which he said:

This, I believe, is the ninth year of the Association's existence; and no doubt many members are yet aware of its early working. I venture to think, however, that a few words now on the subject would not be out of place. Previous to the formation of the Junior Association, I had not the pleasure of visiting any other gas-works than the one that I was engaged upon—viz., from about 1890, which was the year I first started upon my career, leaving school to commence work in the gas offices, Middleton, under the then esteemed Engineer and Manager, Mr. T. Duxbury, now of Oldham. About five years after it was my desire to learn more about gas manufacture, and prepare for examinations on that subject. In the meantime I had been following up chemistry, &c.; so I sought the assistance of the City and Guilds of London Institute, asking them if they could supply me with information as to where I could attend classes for this particular subject anywhere near Middleton or Manchester. They, however, were unable to refer me to a class anywhere near the district in which I was situated, but suggested that I should take the matter up with Mr. Reynolds, of the Manchester Technical School, and Mr. Martin, of the Salford Technical School. I did so; and then the Manchester Technical School said they would see what could be done in the matter, and asked me to suggest to them a satisfactory teacher. This I could not do, as I did not know anyone in the profession outside the gas-works I was connected with; so I wrote back suggesting that they should consult with the head of the Manchester Corporation Gas-Works staff, who, I thought, would be likely to provide a suitable teacher.

The result was that a class for gas manufacture was formed the following session, in 1897; and the teacher was Mr. J. D. Ashworth, now Engineer and Manager of the Portsea Island Gas Company. I believe there were upwards of forty students, which I think was sufficient guarantee that such a class was supplying a long-felt want. However, while the class was such a success with a one-hour lecture, there was a feeling among a few of the students that something more was required—namely, a meeting of students in the form of a discussion class, where we could thrash out the points raised in the lecture, and where students could compare notes, &c. Nothing was done that year; but the following session the idea was acted upon, and a general meeting of the students called to discuss the idea of forming a Manchester Gas Students' Society. This meeting (held about October, 1898) was so successful that another was called about a month later, when the first President and officers were elected, the name fixed upon being the Manchester and District Junior Gas Association. The Association transferred its meeting-place to the New School of Technology when completed; and this has been the recognized headquarters of the Association ever since—for which our thanks are due to Mr. Reynolds, whose name, I venture to state, will be held in the highest esteem by the Association, particularly the older members, who know the value of his assistance to us at a time when it was most required.

I feel that I cannot close my remarks on the early life of the Association without extending thanks to my esteemed late Chief, who, while I was Acting Joint Hon. Secretary to the Association, gave most valuable assistance to me, and because he was one of a few managers who looked upon the Association as a useful organization to gas students, and showed a desire to give it the fullest encouragement. At that time I may say that objections were raised very strongly; but I am proud to state that, after over eight years' experience, it has proved its worth. I allude to Mr. Duxbury. Thanks are due also to the Press for the open manner in which they have promoted the welfare of the Association by extending the use of the valuable space in their weekly issues, &c., for recording our progress. It is through them that we are able now to study our proceedings which are so fully reported. You will see, from the remarks I have made, that I have more than ordinary interest in the Association; but while I may have done some little, I always take a "back seat" where our very highly esteemed Treasurer, Mr. Garlick, is. He is the only member who has held office continually since the very commencement; and he has given more papers than any other individual member, and also contributed to the library. I am sure you will agree with me when I say that the Association is indebted to one who has proved such a true friend. So much for the history of the Association. I am proud to find that we are increasing in numbers. While we commenced with about 20 or 30, we are now up to 125 members, and many have risen from the ranks and occupy positions of management.

We must remember that we are juniors of a very important profession; and that some day we are to take up responsibility vacated by others. In these days of unfair competition, in order to qualify for such positions we cannot learn too much; and nothing can do more good than exchange of ideas and reading of papers. We cannot overlook the fact that the work or duties of a gas manager are increasing every year. Compare the present-day conditions with the time previous to (say) regenerator furnaces, inclined retorts, stoking machinery, and distribution with high pressure, incandescent burners, cookers, fires, gas-engines, heating, &c., all of which come within the scope of a gas manager, and with which he must keep himself in touch.

I am pleased to see there is a tendency for amicable working of Joint Associations, as the joint meetings of the Yorkshire Association with us have proved all that could be desired. A further venture is to be made shortly; and I hope that the time is not far distant when a date will be fixed for an Annual Joint Conference of the whole of the Junior Associations. There is no reason why this should not take place at some convenient centre, as well as the joint publication of our proceedings.

Regarding the work of the Association, I venture to claim that it has played its part in being a means of not only bringing together juniors of the profession, but also of inducing the City and Guilds of London Institute to extend the time for examinations in "Gas Manufacture" from three to four hours, which is something. I venture to think that even this is not sufficient, and that there is room for improvement in the setting of the examination papers. I think the subject is of sufficient importance to be split up into (say) three examinations: (1) Chemistry of gas manufacture, dealing with the various tests relating to a gas-works laboratory for testing of coal and coke, including calorific values, furnace gases, crude coal gas, ammoniacal liquor, tar, carburetted water gas, suction and producer gas, relating to consumers' plants, gas-flames, mantles, &c.; also testing of bricks, fire-clay, materials, oxides, benzol, oils, and even the testing of gas-fires, &c. (2) Problems of gas engineering, more for the construction of gas-works from the beginning, relating to designing of machinery, conveyors, retort-house settings (horizontal, vertical, and inclined), coke-ovens, exhausters, purifying plants, strengths, strains for gasholder, &c. (3) Gas manufacture, to deal with questions of a practical nature and directly concerning the subject, such as the starting-up of settings, precautions to be taken, starting-up and shutting-down of the gas-works for Sundays or in case of stoppages, dealing with back-pressure, naphthalene, and its causes, thickness of layers for oxide purification, lime purification, and action of water on working of pumps. In fact, to include carburetted water-gas manufacture, chimney draught, regulating of dampers, working of regenerator furnaces, and also distribution and questions relating to main-laying, meter fixing, plumbers' rules and regulations, examination of consumers' fittings, class of burners (ordinary, inverted, incandescents), high-pressure apparatus, lamp-governors, cookers, gas-fires, and general smoke abatement, and hygienic problems; lighting, heating, lighting of schools, churches, working of gas-engines, taking of pressures, &c. I feel sure there is sufficient matter which has all to be considered by the would-be gas manager. He should have to answer more than eight questions to qualify for the certificates; and therefore should have even a longer period than four hours for examination, so long as one examination has to suffice for the whole. However, as I understand, the syllabus is somewhat changed for next session; and we have an examiner in the North—Mr. J. H. Brearley, of Longwood—who, I am sure, will give his best attention to perfecting the subject with which he will have to deal.

It was my intention, when I accepted the vice-presidency last year, to give a full and complete report on the undertaking which I have had the honour to represent during the past five years, as the Gas Board have in contemplation some extensions. But I am sorry to say the progress has not been sufficient for me to mention any details to-day; so, with your permission, I will content myself with a few remarks on the works generally. They were in the hands of a private Company until 1894, when they were purchased by the two Local Authorities of Hebden Bridge and Mytholmroyd. At that time the make of gas was 48,830,000 cubic feet, and the purchase price was over £69,000—27½ years' purchase of the maximum statutory dividend of £2517 6s. 2d. Since that time the item has been increased to £91,000, and the make last year was 85,359,000 cubic feet.

The works are situated near the railway station—in fact, about one-third of the land is leased from the Railway Company—and joins up to the main line with a private siding. The site is a long, narrow strip of land, surrounded on practically three sides by the Railway Company's property; while on the other is a narrow road leading to the works. Our output has exceeded 500,000 cubic feet per day; and we have coal storage for about 500 tons only, which is about ten days' supply.

The retort-house contains ten single beds of sevens on the direct-fired system, and capable of producing 420,000 cubic feet per day. The tar and liquor well and coke storage are both in the retort-house; and the former is a constant source of anxiety, as we are tipping hot coke on to it every hour. We have one set of Humphreys and Glasgow's carburetted water-gas plant, capable of producing about 200,000 cubic feet per day. There are two exhausters, one to deal with 10,000 and the other with 8000 cubic feet per hour; and while we are making up to 28,000 and 30,000 cubic feet per hour in the winter, we are, of course, compelled to have the two working at the same time. There are two sets of condensers, one atmospheric and the other water cooled. The scrubber and washer is capable of dealing with 400,000 cubic feet per day.

There is one set of four purifiers, 25 ft. by 15 ft.; and we use both lime and oxide in the same boxes. The revivifying floor is under the purifiers, and enclosed in the purifying-house, with just a passage to get to the retort-house. The station meter has a capacity of 20,000 cubic feet per hour, and has been in use about 28 years. We have one relief holder of 20,000 cubic feet, and one gasholder a mile from the works, of 500,000 cubic feet.

There is an 8-inch main leading some distance from the works from the station meter, connected to a 12-inch main running to the holder one way and to Hebden Bridge the other; so that you will see the difficulties we have for working. We have no room for extensions, we are working at a maximum, we have no stand-by, and the gas is passing right on to the consumers in Hebden Bridge practically without going into the holder at all. The inlet to the gasholder acts as an outlet as well; and in this manner the holder is in a sense a compensating governor, as it were, because when we are making more gas than is demanded the extra quantity goes to the holder, and if the demand is greater the gas comes back out of the holder. We have no other governor in Hebden Bridge; and the pressure is whatever may be given by the gasholder and the output from the works.

Again, the inconvenience of working with only one holder, and that more than a mile from the works, is great, because you cannot keep an eye on your storage; and many a time we have lost as much as 100,000 cubic feet from stock from a Monday morning to a Tuesday, or, *vice versâ*, have put into stock a quantity more than intended. Besides, the gas varies in quality, being anything between 18 to 20 candle power, according to the charges and how the engine foreman is running the exhauster. This interferes somewhat with the working results, as we are not able to run any risk. If the gas got below the proper quality, the consumer would find it out immediately; and we are ruled by the worst gas we turn out, because the consumer tells us of it quickly, whereas we never hear about it when the gas is upwards of 20 and 22 candles. They do not notice this. Again, we only work the carburetted water-gas plant during the winter months; and we have difficulty in maintaining uniform quality, for the reason that we have to vary the mixture from 10 per cent. to 25 per cent. carburetted water gas, according to the demand. Many a time during 24 hours there will be no carburetted water gas, then 10, 20, or 25 per cent., and then none again.

You will say, from these particulars, that it is time something was done to remedy these conditions; but I can assure you the difficulties are great. The Gas Board are doing all they can; and my thanks are due to them for the consideration they give me while working under our winter conditions. With works over-capitalized, a non-growing district, and the talk of remodelling, or building new works, including purchase of ground, it is a hard nut to crack for the Local Authorities, and needs more consideration than appears on the surface.

I hope on some future occasion to place a more detailed statement before you, showing how the difficulties have been surmounted; but at present I must leave the matter here—negotiations not being sufficiently far advanced to make a broader statement.

Mr. C. Woodhead moved a vote of thanks to the President for his address. To find a subject for a presidential address was very difficult. It was not easy to take up a new line of thought that would interest all the members. Their new President, however, had given them a great deal to think about. They had secured in him a good man to preside over them, as was shown by what he had done; and he believed the welfare of the Association would be furthered under his guidance.

Mr. J. Taylor seconded the motion, which was supported by several members, and carried with hearty applause.

The President, in acknowledging the compliment, spoke of some of the difficulties he had had to contend with at the Hebden Bridge Gas-Works.

Complimentary speeches were delivered by Messrs. Cranfield, C. E. Teasdale, and W. T. Duxbury, of Oldham; the latter giving some interesting particulars of the President's early career, his work at Hebden Bridge, and the difficulties he had to encounter. He said Mr. Wellens's motto had been "*Nil desperandum.*"

A smoking concert followed the business meeting.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Insurance Offices and Compensation to Workmen.

Sir,—I am not, unfortunately, usually in the way of seeing the "Journal of Gas Lighting;" but a friend has sent me your article in a recent issue dealing with the premiums charged by the Insurance Companies; and I should like, in the first place, to acknowledge the perfect fairness with which the matter is stated from the employers' point of view. But may I add that it is stated from that point of view only? It has, I fear, been overlooked, as is frequently the case in these public discussions, that the essential foundation of insurance rates is the law of average. In the article referred to, the general question is really decided upon particular cases. I grant that the experience of the Sheffield Gas Company quoted is fairly substantial, and would count as an important factor in any total in which it might be included. But I venture to say that by itself it does not prove the proposition advanced by the writer—indeed, it is admitted, in so many words, that the experience "allows of no margin for any serious contingency." But is this not an element of the first importance, and does its omission not strike at the very foundation of insurance? To treat it as a question of mere income and outgo is to argue much as the promoters of the American Assessment Companies argued, whose specious arguments secured the support of, and brought disaster to, so many thousands of otherwise hard-headed Britishers.

It is said that, assuming the Act of 1906 had been in operation during the period under review, the amount which would have been paid in compensation would have been increased from £1798 to £2286; but how do the compilers of the figures know this? It is continually being asserted that the effects of the 1906 Act cannot be known to Insurance Offices. But does not the quotation of these figures assume that they are known very precisely to those who have made the calculation?

Now I venture to contend that no gas company has had the experience that the Insurance Companies possess, and that no individual connected with the working of a gas company can possibly be able to estimate the effects of the new Act with the accuracy of those who have made it their life business, and who have before them the accumulated statistics of all the principal offices since employers liability insurance was started some 27 years ago.

Assuming, in the Sheffield case, that 8s. per cent. will be enough to pay the actual claims, what about the serious contingencies for which no provision has had to be made? Of course, if a corporation or a company keeps its own risk, it will have to meet these as a future liability, and the shareholders or the ratepayers, as the case may be, will have to bear the brunt in years to come. But an insurance company may only get a premium for a single year, and be saddled with claims extending over a lifetime. Then the claims themselves require attending to; and this cannot be done without expense. Some part of the time of the officials connected with the various gas companies will, no doubt, be given up to this work, just as some part of it is already given up to the statistical work which the figures quoted represent. But apparently no value is put upon this time, and no provision for it is included in the total outlay; yet it is clear that either extra assistance, involving extra salaries, is being obtained, or that without this special work the staff would not be fully employed. The insurance company in like manner must pay its staff reasonable remuneration; and the premium must necessarily be large enough to provide for the contingencies referred to, as well as for this expense and a small margin of profit.

Sheffield is the most important illustration given, and therefore I dare not trespass upon your space to refer in detail to the other examples. But what I have said of the one applies to all. I might, however, just make one very brief reference to Mr. W. R. Herring's experience. The claims actually paid, it is stated, amounted to 2s. 9d. per cent. on the wages paid. But suppose the claims under the fire policies, which have, no doubt, been in existence all this time, have amounted to nothing, as is probable, would the argument be that the fire insurance premium is too high? If not, why not?

It is a remarkable fact, and one that is indisputable, that hundreds of thousands of pounds have been lost by the Insurance Companies since the passing of the Act of 1897; and this hardly proves the contention that they are exacting in the rates they charge.

Charlotte Square, Edinburgh, Sept. 30, 1907.

Henry Brown, General Manager, Century Insurance Company.

[We thank our correspondent for the courteous reasoning that he bestows upon the editorial article in the "Journal" for Sept. 17; but we could wish that he had not assumed that the Insurance Companies, although their official advisers have made a life study of these matters, possess an almost infinite wisdom in regard to them, and that he had

given those who have made it their life business to know something of what goes on inside gas-works an amount of credit for being able to gauge the possible effects of the new Act with as near an approach to accuracy as the man without technical knowledge of the industry, and who works only on the incomplete accumulation of statistics that he has at hand—incomplete through many important gas undertakings being their own insurers. Mr. Brown must not harbour the idea that this question of insurance has, from the employers' point of view, been dealt with on two or three particular cases, or on an individual's experience in working a single gas undertaking. If he does, he harbours an error. Many leading administrators of gas undertakings who have looked into this question, and are adopting a course independent of the insurance offices, have personal experience extending over a long series of years and in several undertakings, all working under different conditions. It is feared by Mr. Brown that it has been overlooked that the essential foundation of the insurance business is the law of average. Applying that law to the experience of the past in gas-works, what is the result? Mr. Brown does not say, nor does he categorically plead that it defends what we are bound still to believe, from our inner knowledge of the gas industry, to be extravagant views as to premium for the insurance of gas workers. With regard to the Sheffield case, our correspondent does not appear to have the facts quite within his grasp. The Sheffield Company, applying the law of average as framed by their own experience, and making an allowance for the additional risk imposed by the Act of 1906, calculate that 6s. 0·84d. per cent. on wages would suffice, but would "allow no margin for any serious contingencies." Therefore, the 8s. per cent. on wages that they have determined to set aside, and which incorporates provision for serious contingencies. Reverting to Mr. Brown's contention that "no gas company has had the experience the Insurance Companies possess, and that no individual connected with the working of a gas company can possibly be able to estimate the effects of the new Act with the accuracy of those who have made it their life business," we, on the other side, contend that the individuals intimately associated with the gas industry must know more about the risks—and the now declining risks—of gas manufacture than any insurance office. When the first Compensation Act came into force, was the estimate of the Insurance Offices of premiums for gas workers made with "accuracy" by those who have made insurance "their life business?" because, if so, how came it that the premiums were subsequently reduced when the managements of gas undertakings showed active resistance to the demands? As subsequent events have proved, gas managements then made an estimate of greater accuracy than the Insurance Companies, notwithstanding that the officials of the latter had made the question "a life business." There is nothing in Mr. Brown's letter sufficiently material to alter our view that the Insurance Offices have again involved themselves in a mistake so far as gas undertakings are concerned. The time demanded of a gas-works staff through the management adopting self-insurance is not so considerable, nor the work so onerous, that the administration expenses will be worth any great consideration. That conclusion is also drawn by applying the law of averages to the experience gained in certain large and representative concerns.—Ed. J.G.L.].

Gas-Heating.

Sir,—Your remarks on the subject of gas heating contained in the last issue of the "Journal" were brought to the notice of a Committee of the Council of the Institution of Gas Engineers at a recent meeting, when it was arranged that the matter should be referred to the Special Purposes Committee of the Institution for consideration and report to the Council. The advantage of acting in conjunction with the Society of British Gas Industries was felt; and the Committee hope some united action will be possible.

Walter T. Dunn,
Secretary, Institution of Gas Engineers.

39, *Victoria Street, S.W., Oct.* 5, 1907.

Sir,—Referring to the editorial notice on the above subject in your last issue, I should like to say that the Council of the Society of British Gas Industries have had this question before them for some weeks. Preliminaries have been already entered into with the architects, and it was hoped that a conference could have been arranged for this autumn; but the time has been found inconvenient. It was the intention of the Council to ask for the co-operation of the Institution of Gas Engineers as soon as that of the architects had been definitely obtained; but I need hardly say that any suggestions from the Institution at the present stage will be welcomed by the Society; so that arrangements may be made for holding the conference in the spring of next year.

Arthur L. Griffith,
Secretary, Society of British Gas Industries.

46, *Queen Victoria Street, E.C., Oct.* 4, 1907.

At the first meeting of the winter session of the Salford Science Students' Association, which took place in the Engineering Lecture-Room of the Royal Technical Institute, Salford, last Saturday, Mr. Frank H. Robinson, of the Rochdale Road Gas-Works, Manchester, delivered an interesting lecture on "The Manufacture of Coal Gas," which was illustrated by a number of new and original lantern slides.

LEGAL INTELLIGENCE.

THE ERECTION OF A GASHOLDER IN ELGIN.

The Question of Dispensing with Consents.

Sheriff Wilson, K.C., last Friday issued his decision in the application of the Town Council of Elgin for an order dispensing with the consents of owners of properties and residents within 300 yards of a proposed site for the erection of a holder in connection with the gas-works of the Corporation. A report of the inquiry before the Sheriff in relation to the question was given in the "Journal" for Aug. 27 last (p. 581).

The Sheriff finds it proved that the petitioners duly gave the notices referred to in the prayer of the petition; and as regards those owners, lessees, and occupiers of dwelling-houses, situated within 300 yards of the site described, on which the petitioners propose to erect a gasholder, who have refused or delayed to consent in writing to its erection, he finds and declares that such consent may and ought to be dispensed with; and he finds no expenses due to or by any party in connection with the present application.

In his opinion attached to the decision, Sheriff Wilson says: The Town Council of the City and Royal Burgh of Elgin are the Commissioners, under the Burghs Gas Supply (Scotland) Act, 1876, and the amending Act of 1893. In consequence of the increased demand for gas, the petitioners were advised by their Gas Manager, as far back as December, 1904, that additional storage accommodation for gas had become necessary. On Jan. 21, 1907, the Gas Manager again called attention to the matter, in a report in which he stated that the maximum daily make of gas had reached 200,000 cubic feet, and that the daily "draw" amounted to 180,000 cubic feet; while the capacity of the existing holders at the works was only 80,000 cubic feet. The petitioners therefore consulted a gas expert (Mr. A. Yuill, Gas Manager, Dundee) on the position; and in April, 1907, he confirmed the local Gas Manager's representation as to the urgent need for an additional holder, and advised that a new holder ought to be provided, with a capacity equal to the maximum requirements—viz., 200,000 cubic feet—so as to leave the existing gasholder accommodation, representing 80,000 cubic feet, available to meet future demands.

In view of the reports and skilled advice to which I have referred, the necessity of providing a new gasholder was apparent; and the only difficulty which arose related to the site on which the holder should be placed. No sufficient space being available for the purpose on the site of the present gas-works, the Commissioners were obliged to look out for a convenient site for the new gasholder elsewhere. Three sites were specially considered: (1) Lossie Green, which adjoins the gas-works; (2) ground at Pans, which is contiguous to the burgh sewerage works; and (3) the vacant ground at the back of the Corporation Lodging-House, known as North Lodge. Of these sites, Lossie Green would probably be the most suitable and convenient, because of its immediate proximity to the gas-works. The petitioners, however, came to the conclusion, I think on good grounds, that Lossie Green should be regarded as not available for their purpose. It appears that Lossie Green was acquired, and is now held by the Town Council, on a title which expressly provides that it shall be kept open in all time as an exercising-ground; that it shall be inalienable by the town; and that it shall be held, used, and laid out for ever solely for the purpose of recreation and amusement, and for ministering to the health and comfort of the inhabitants of the town. As regards the ground at Pans, Mr. Yuill, in his report to the petitioners, stated that he would not recommend this site unless the petitioners contemplated the early removal of their whole gas-works to the same place. Mr. Yuill added that in his opinion there was no present necessity for removing the works; and he recommended the petitioners to continue them on their existing site, and secure ground for the gasholder elsewhere.

In this state of matters, the petitioners ultimately decided that they ought to utilize as a site for the new gasholder certain vacant ground belonging to them adjoining the Corporation Lodging-House at North Lodge. Accordingly, on June 25, 1907, they, in terms of the statute, sent by post notices intimating their intention to erect the gasholder on that site. The notices were addressed to 513 persons, being the whole of the owners, lessees, and occupiers of dwelling-houses within 300 yards of the proposed site. Thereafter the present proceedings were begun before me, for the purpose of satisfying me that certain consents might be dispensed with, in virtue of the provisions of section 3 of the statute of 1893. On July 30, 1907, I pronounced an interlocutor, appointing Aug. 20, 1907, at Elgin, as a diet for hearing the petitioners and any objectors. At the diet referred to, certain objectors (twelve in number), who were all represented by Mr. Jameson, Solicitor, Elgin, opposed the granting of the petition. Evidence was laid before me, at considerable length, both by the petitioners and the objectors. At the close of the day's proceedings, I made avizandum; but at the same time I suggested that the parties might reconsider the position in the light of the evidence which had been adduced. Both parties concurred in asking me to delay deciding the case pending their negotiations. In the result, however, it has been found necessary to have the question raised by the petition determined judicially, as the parties themselves have been unable to come to any agreement.

In my opinion, the petitioners have made out a sufficient case for dispensing with the consent of the owners, lessees, and occupiers whose consent had been withheld. I think it unnecessary and inexpedient to deal in detail with all the questions raised or suggested in the course of the proceedings. It seems reasonable, however, that I should explain briefly the views which I have taken with regard to the chief grounds of objection. In the first place, I think the North Lodge site selected by the petitioners is probably the best available to them. The ground in question belongs to the town; it is held on an absolute title; and it is not required for any other purpose. It is close to the gas-works, and its proximity to them means the saving of money in more ways than one. Its immediate surroundings are of such a character that the addition of

a gasholder would not be incongruous or unsuitable—the present gas-works, the shambles, the sorting depôt of the cleansing department, engineering works, and the Corporation Lodging-House, being all situated within 100 yards of the proposed site. In the second place, the evidence satisfied me that there is no good reason to anticipate that the gasholder would occasion any noxious or offensive smell. What is to be put down on the site is not a gas manufactory, but merely a gasholder; and it was proved that, apart from some temporary accidental leakage, no smell, or at least no smell that could be detected within a few feet of the holder, would be caused. In the third place, I think it was also proved that there is no risk of accidental explosion of the gas in the holder. Fourthly, with regard to the objections to the effect that the appearance of the gasholder would offend the eye, and that the view from the objectors' houses would, to some extent, be obstructed, I think that, in so far as these objections are at all material, they are applicable to only two or three of the objectors. Moreover, as regards these two or three objectors, the obstruction which they anticipate is not an injury peculiar to a gasholder. Similar obstructions to, and interferences with, outlook and scenery would follow if any high building—a high tenement, the tall chimney of a manufactory, or the spire of a church—were erected in the line of view. On the whole, my opinion is that any interference with the outlook and scenery likely to be caused by the gasholder would not constitute an injury of such a character or degree as to make it reasonable on that account to prevent the Town Council from using the site they have selected—a site which, owing to its position and surroundings, is very suitable, and which, as regards the economical and efficient management of the gas undertaking, seems to be the best available. There is only one other point to which I think it right to refer. In the course of the evidence, I suggested it might be found practicable to lessen the height of the holder above ground; and if the petitioners should find that, without serious increase of expense or loss of efficiency, they could sink the foundations 15 feet or thereby below the level of the ground, I dare say they will, to that extent, give effect to my suggestion.

Winchester Public Lighting.—The contract for the public lighting of Winchester has been increased by 15 per cent. by the Winchester Water and Gas Company, on account of the high price of coal. The Corporation, however, would only consent to the arrangement being for one year; the Mayor observing that it would be unwise to enter into a longer contract at the enhanced price.

Duplication of the Plymouth Water-Main.—Tenders for the pipes and valves required for the duplication of the trunk main by which the water supply of Plymouth is conveyed between the reservoirs at Roborough and Crownhill were opened by the Water Committee of the Corporation last week. It was decided to accept the tender of the Stanton Iron-Works Company for the pipes, for the sum of £7392, and that of Messrs. Blakeborough and Sons for the valves, at £330. The work is to be carried out by direct labour, under the supervision of Mr. F. Howarth, the Water Engineer to the Corporation.

Turin Gas Supply.—In the report presented at the recent meeting of the Turin Gas Company, it was stated that the consumption of gas for the year 1906-7 was the greatest since the formation of the Company; amounting to 10·87 per cent. more than that of the previous year. The value of the gas sold was 2,768,471 lire (£110,739), representing an increase of 10·46 per cent. compared with the preceding year. In the twelve months covered by the report, 55,956·7 metric tons of coal were carbonized to produce 17,944,650 cubic metres (about 600 million cubic feet) of gas. On Dec. 31 last, the third contract with the Municipality for the supply of gas expired, and a new one is under consideration. The result of the working was a balance of 41,471 lire (£1659), compared with 48,970 lire (£1959) before. Reference was made to the unveiling of the memorial of the late Sig. L. Beria; and the work of the present Manager (Sig. G. Beria) was highly commended.

Water Supply for Carbis Bay.—It was decided by the West Penwith Rural District Council last week to carry out a scheme of water supply for Carbis Bay, a village on the coast near Penzance, which has experienced shortage of water during recent summer seasons. Mr. F. C. Wren, the Engineer consulted by the Council, estimates the cost of the scheme at £3150; and it is proposed to obtain a loan for this amount. Payment of interest and contribution to a sinking fund will necessitate a water-rate of about 3s. 6d. in the pound. The source of supply is two springs on Treva Moor. The water will be piped to a pumping-station, and pumped thence to a storage reservoir which will be constructed at a height of 320 feet. It is proposed to utilize the power of a mine stream to pump the water, and to put down an 11-H.P. oil-engine for use during the dry season when the stream is too low to be effective for the purpose. It was stated that the supply would be sufficient for double the present summer population of the place.

The Oil-Gas Enrichment Company, Limited.—The Directors of this Company, in their fourteenth annual report to the shareholders, state that the balance at the credit of profit and loss account for the year to Sept. 30 was £967 12s. 11d., which they have carried to the credit of depreciation of investments account. The Company's principal patent expired on July 5, 1906. The subsidiary patents expired on June 23 and July 7 last respectively; and the Company now falls to be wound up and the assets divided among the shareholders according to their respective interests. The investments held by the Company originally cost £6200; but their value, as at the 30th ult., was about £5118. Should they realize this value, the sum in hand, after paying the Company's liabilities, would permit of a return to the holders of the preference, or "A," shares, of nearly the full amount paid on each share. There would, however, be nothing available for division among the holders of the deferred, or "B," shares. The Directors think it right to point out that but for the depreciation in the value of first-class securities in which the funds of the Company were invested some years ago, there would have been a considerable surplus. The annual general meeting of the shareholders will be held on the 15th inst.; and immediately thereafter an extraordinary general meeting will be held, for the purpose of passing a resolution approving of the Company being wound up voluntarily.

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Offices, D'Olier Street, Dublin, on Monday last week—Alderman W. F. Cotton, D.L., J.P., in the chair.

The Secretary and Manager (Mr. Francis T. Cotton) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ending the 30th of June, the principal figures in which were given in the "Journal" last week (p. 45), was presented.

The Chairman, in moving the adoption of the report and accounts, said the total revenue derived from the sale of gas and meter-rents in the six months ending June 30 amounted to £130,634, being an increase of £1880 compared with the corresponding period of last year. Residuals realized £15,975—an increase of £1488 for the same period. Turning to the expenditure side of the accounts, coals cost £4039 more, purifying materials £367, wages £702, automatic and incandescent fittings £549, abatements and allowances £503, and law charges £495, or a total expenditure of £6288 in excess of the first half of 1906. The gross profit on the half-year's working amounted to £39,119, subject to the payment of debenture interest, &c., £6538; leaving a net profit of £32,581, to which was to be added £770 carried from last account, making the available balance £33,351. This amount being insufficient to pay the dividends recommended by the Directors, it would be necessary to have recourse to the reserve fund, and draw therefrom the sum of £3556. Considering the great depression in business to which a large portion of the trading community of Dublin had been subject during the six months under review, the Directors were of opinion that the accounts might be regarded as satisfactory. Doubtless the shareholders would like to have some explanation regarding the heavy law costs which appeared in the accounts. They arose in this way: Acting on a report of the Lighting Inspector of the Corporation, the Lighting Committee of that body took proceedings against the Company for alleged defects in the illuminating power of the gas on the 28th and 29th of January and the 4th of February last. At that time the whole of the Company's works were more or less disorganized, consequent on a most disastrous explosion which occurred—resulting, unfortunately, in the death of two of the employees and injury to sixteen others. The case was before the Police Courts for several days each side being represented by two Counsel. After a very thorough investigation, the Magistrate gave judgment. He fined the Company £1 for the night of the 29th of January, with £4 costs. The Company having admitted throughout the investigation that the gas was below the standard that night—the result of the accident referred to—the Magistrate had no alternative. With regard to the other two nights, he dismissed the summons, and awarded the Company £20 costs for each of the nights referred to. He (the Chairman) wished to call particular attention to this—that, at the lowest estimate, the costs for both sides would amount to about £800. This was nothing short of a waste of money, which came out of the pockets of the consumers of gas, both public and private. He could understand the representatives of the Corporation taking proceedings if the gas were consumed under old conditions; but, seeing that it was a well-established fact that the difference in the light given between 14 and 16 candle gas when consumed in incandescent burners was infinitesimal, and that the enriching of gas, so as to comply with the high standard in Dublin, was a thing of the past, except in Dublin, it was hard to understand the action of the Committee. It was beyond doubt that, owing to the conditions under which gas was tested in Dublin, the ratepayers and consumers were at a loss of some thousands of pounds annually, both for public and private lighting. He was quite confident that, had the question of taking proceedings been submitted to the Municipal Council, the decision of that body would have been against that of the Lighting Committee. On the last occasion when they met, he informed them of the intention of the Directors to rebuild one of the large retort-houses at their No. 2 station—that in Great Brunswick Street. The building was in course of construction; and it would be fitted with all modern improvements for the production of gas. Their Engineer (Mr. W. F. Cotton, jun.) was hoping to have it completed and ready for use by the winter of 1908-9. The whole of the outlay on this work of re-construction would be charged to the ordinary revenue expenditure, and spread over some years; so that the Directors did not anticipate any large outlay on capital account during the coming twelve months. The automatic, or, as it was better known, the slot-meter system was largely on the increase. The Company found it difficult to meet the demand for this class of lighting; and it was anticipated that during the coming winter it would be greatly increased. People of moderate means, who could not afford to pay the higher price of coals, would, no doubt, be anxious for a supply of gas—it being well-known that a jet or two of gas consumed in an ordinary-sized room would increase the temperature to a uniform degree in less time and with greater economy than a coal fire. During the past half year, there had been put into operation 2596 new cookers and 1450 new installations, including, in most cases, a pendant and two gas-jets. There were also 253 heating-stoves and fires. The Directors had had under consideration the responsibility cast upon the Company under the Workmen's Compensation Act, which came into operation on the 1st of July last. They had resolved to become their own insurers; and, with this object in view, a fund would be formed for the purpose of setting aside annually a certain percentage based on workmen's wages. A number of gas companies had adopted this course, in consequence of the enormous demands made by the Insurance Companies. He regretted to say the coal market was still in a state of uncertainty. Prices had risen to abnormal figures during the past six months, and it would seem that there was no prospect of abatement in gas coals for some time to come; prevailing prices being about 6s. per ton in excess of the Company's present contract. No doubt the remission of the coal duty had increased the foreign demand to an extent which must prove detrimental to the industries of the country, and inflict enormous hardships on the poor during the coming winter.

Owing to the increased cost of coals and oils, a large number of gas companies and local authorities had been obliged to raise the price of gas—in some cases as much as 6d. per 1000 cubic feet. At Dublin, they had been fortunate in this respect, as up to the present they had not felt, to any appreciable degree, the increased cost of coals or oil. There remained to be delivered under the existing contracts, made 2½ years since, some low-priced coals, from which the consumers would have the benefit during the current quarter. Negotiations were pending at present for new contracts. The Directors expected they would result in having to submit to higher prices, such as would involve an increase in the price of gas of 3d. per 1000 cubic feet; and the proprietors would, under these exceptional circumstances, be asked to submit to some slight reduction in dividends. He understood the Corporation had entered into a contract for a supply of coals for the generation of electric current at an additional cost of about £3000 per annum. This must result in either a higher charge per unit for electric light or an increased loss to the ratepayers, whether the latter were users of electric light or otherwise. He might say, in conclusion, that the outlook for gas undertakings was never better than now. The check which was given to the output of gas by the general adoption of incandescent gas lighting led to enormous economy in consumption, and was felt for some time by all gas companies. It had now, however, had its full effect, and the time had come when the companies would have the advantage of the increased consumption from new customers, which heretofore had not been felt owing to the introduction of incandescent lighting.

Mr. CHARLES LAWLOR seconded the motion, and it was carried.

The usual dividends of 10½ and 7½ per cent. per annum having been declared,

Mr. S. DAVISON, in proposing a vote of thanks to the Chairman, Directors, and officers, said the shareholders were very pleased to hear so hopeful a view expressed by the Chairman.

The proposition having been carried,

The CHAIRMAN, in acknowledging the vote, remarked that the shareholders need not be uneasy at drawing on the reserve. They had done this previously up to £11,000 or £12,000, and when times became better they had built it up again.

Mr. F. T. COTTON acknowledged the vote on behalf of the officers, and the proceedings terminated.

With reference to the remarks of Alderman Cotton on the subject of the litigation between the Corporation and the Company, Mr. John J. Farrell, the Chairman of the Lighting Committee, has sent a copy of a letter addressed by him to the "Freeman's Journal," in the course of which he points out that the Alderman was not justified in omitting from his comments the fact, which was within his knowledge, that an appeal against the Magistrate's decision awaited hearing. With regard to the estimate of £800 as the cost of the litigation, Mr. Farrell characterizes it as an "excessive exaggeration," and says that, including the appeal, they will not exceed £150; and, moreover, the proceedings were not instituted by the Lighting Committee, but by order of the Municipal Council, made at a meeting at which Alderman Cotton was present and protested. As an Alderman and a member of the Council, therefore, he was one of the plaintiffs—thus "occupying the unique position of suing himself and the Gas Company of which he is Chairman and Managing Director." In this capacity, says Mr. Farrell, "he gives the public to understand that the defect in the illuminating power of the gas in January and February last was owing to an accident in the Company's works, 'which were more or less disorganized consequent on a disastrous explosion which occurred, resulting unfortunately in the death of two of the Company's employees and injury to sixteen others.' The correspondence between the Lighting Committee and the Gas Company contradicts this; while in the report of the accident when it took place it is stated that 'little damage has, however, been done to the plant, and the supply was not materially interfered with.'" Coming to the portion of Alderman Cotton's remarks in which he dealt with the quality of the gas, which had given rise to the litigation, and to his explanation as to the old conditions of consumption as compared with the modern incandescent system, which was stated to cause the difference between 14 and 16 candle power to be "infinitesimal" to the consumer, Mr. Farrell remarks that the error here is one of magnitude. He says: "The difference continues to be as ponderous as ever, no matter what economy arises from incandescence; for if the standard of the quality supplied by the Company be 14 instead of 16 candles, the consumer must use a greater number of jets to produce illumination equal to that obtainable from the full minimum standard of 16, with the privilege, of course, of paying for the necessary excess in quantity, while the public and private lights which are not incandescent show, in addition, a greater loss of illumination."

GAS AND ELECTRIC LIGHTING IN ROCKHAMPTON.

At the Sixty-Ninth Half-Yearly Meeting of the Rockhampton (Queensland) Gas and Coke Company, which was held on the 15th of August, under the presidency of Mr. G. F. Sandrock, the Chairman, the Directors reported that the profits for the six months ending the 30th of June, after providing for the interest on debentures, &c., and writing off £1177, amounted to £711. From this sum they recommended the payment of a dividend, free of income-tax, at the rate of 9 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares. The payment of the dividend would absorb £677, and leave £34 wherewith to pay the income-tax. The accounts showed a balance of £2352 on the gas revenue account, and a loss of £18 on the electric lighting account.

The Chairman having moved the adoption of the report and the accounts, Mr. Boland thought they showed that the Company were making steady progress. In his opinion the Company had never been in a sounder position than to-day, and for this reason—that while the profits earned for the past half year were the largest since the Company had embarked upon the supply of electric light, these profits were earned on sales of gas at reduced rates all round. In this, he thought, lay the chief strength of the balance-sheet. In the first year after the introduction of the reduced rates for lighting, the loss of revenue exceeded £1000. This was a smashing blow at probably the most critical time in the history of the concern. But the profits for the past six months showed that the Company was a sound 5 per cent. investment on its ordinary shares. Mr. A. S. Tompson said he agreed thoroughly with all Mr. Boland had said with regard to the strengthened position of the Company and the splendid results that had accrued from the past half-year's work. The balance-sheets for the last seven years, if looked into, made interesting reading. Taking the revenue side first, they would find that in the first four years of that period—1900 to 1903—the average revenue produced from gas was £4632; while for the last 3½ years it had been £4232 a year. If they took the expenses charged to gas revenue for the first four years, they would find they totalled to an average of £4772 per annum. But it was only fair to record, with regard to these figures, that there was a heavier charge made at that time against the gas revenue for discounts—he thought it would run to £500 a year; so that £4222 would be a better figure for comparison. In the last 3½ years—that was to say, from 1904 to the term which closed on the 30th of June last—the average had been £3720. These figures showed that economy had been practised in that department. If they took the Electric Light Department, they would find that for the first four years the average charges against the revenue were £1954; while for the last 3½ years they had been only £842. Turning to the profit and loss account, and taking interest and other things that were charged annually, they would find that for the first four years of the period £1264 per annum was charged; while for the last 3½ years the charges had been only £1040. These figures were evidence of strict economy. The better position which the Company now occupied was not at all attributable to a larger income—for the income had been straitened a good deal by the reduction in the price of gas to which Mr. Boland had referred—but was really the outcome of strict economy. Mr. W. G. Thompson said he saw much room for congratulating the Directors on the policy they had adopted, and on the considerable reduction made in the expenses. At the same time, he thought the assets were represented in the balance-sheet at figures which were entirely beyond their proper value. He considered that the best thing would be to reduce the capital; and it seemed to him that the electric light plant and business—the unprofitable part of the undertaking—might well be cut out. This, however, was a matter for expert advice, with which, no doubt, the Directors had fortified themselves. While they had made praiseworthy reductions out of profits, this was a slow process of bringing about the desired result. Mr. Thompson said the amounts which had been written off were: In 1904, £1501 and £1237; in 1905, £504 and £1573; in 1905, £681; in 1907, £1177. Mr. Thompson said he quite appreciated the lines on which the Directors were going. As time went on and conditions improved, their policy might come out all right; but if he had to deal with the question, he would do so now. The motion for the adoption of the report and balance-sheet was carried; and the dividends recommended were declared.

CASTLE DONINGTON PUBLIC LIGHTING.

At the monthly meeting of the Castle Donington District Council, the Chairman (Mr. Laurence Stevenson) said an extraordinary communication had been received from the Secretary of the Gas Company, to the effect that the Company would hold the Council responsible for their action in preventing them fulfilling their contract to light the town. The Company were prepared to carry out the contract, but could not do so because he (the Chairman) declined to have the lamps lighted. The letter also stated that the Secretary had forwarded the communication by the instructions of his Directors. The Chairman explained that, together with another member of the Council, he had been appointed to direct the public lighting of the town; and they had exercised their discretionary powers, and would continue to do so. The Sub-Committee had decided to abandon the public lighting until such time as the Company could fulfil the contract. Mr. Poxon thought the letter a highly improper one; and Mr. Lambert (a Director of the Company) said that the subject-matter of it had never been before any meeting of the Board. A resolution was passed declaring the Council's confidence in the Sub-Committee, and their entire approval of the Committee's action, and that the letter from the Secretary to the Gas Company was an improper communication to make to the Council.

Subsequently, it was decided to make a call upon the Overseers for £115 for public lighting purposes. The Chairman said this would necessitate a rate of 4½d. in the pound on property and 1½d. on land. This was in advance of the rate of last year; but the Council had appealed to the ratepayers on the question, and they had virtually assented to the additional demand of the Gas Company, and therefore had no ground of complaint. The Council would be aware that the Castle Donington Gas Company had just been sold, with the entire plant, to the Draycott Gas Company. He had been in communication with the official representative of the Draycott Board of Directors, with a view to their receiving a deputation from the Council to confer upon the general question of public lighting. As soon as necessary legal formalities involved in the transfer of the Castle Donington Company were completed, there was every reason to expect that such a conference would be held, when they hoped to reach a satisfactory settlement of the whole question.

Crewkerne Water Company and the Proposed Purchase.—A letter from the Water Company with reference to the proposed purchase of their undertaking was read at a meeting of the Crewkerne Urban District Council yesterday week. The Directors stated that they had again considered the correspondence on the subject, and understood that the Council offered for the whole of the Company's property and interests (except book debts and dividends and income accrued to a date to be fixed), as a going concern, the sum of £14,500, *plus* the reserve capital of £983. On receipt of the Council's reply, the Directors were prepared to put it before the shareholders, and recommend them to accept it. The Council decided to consider the subject in Committee.

GAS STOKERS' CONDITIONS AT STOCKPORT.

Trade Union "Recognition."

The minutes of the Gas Committee submitted at the monthly meeting of the Stockport Town Council last Wednesday stated that four of the stokers attended before the Committee on Sept. 12, and asked for the following concessions: (1) That they should not be required to deal with more than 64 mouthpieces per shift; (2) that the clinker and ashes should be wheeled out for them; and (3) that a week's holiday with full pay should be allowed to the stokers employed all the year round. The men were informed that the Committee would consider the requests at the next meeting.

Referring to this portion of the minutes, Mr. Linfoot remarked that he was present with other members of the Council when the new retorts were recently formally inaugurated. He did not know how the work at the present time compared with that previously done under the old system, because he had not had experience of it. The present work, however, appeared to be very exhausting; and it seemed to him that the men needed some additional help. He had never seen men working so hard and perspiring so freely. The Committee had refused to see the representatives of the men, the District Secretary and the Local Secretary of the Union. The recognition of the Trade Union officials was a very important question throughout the country; and the Committee had deliberately declined to recognize the men's Union. It was always agreed in Trade Unions that the proper persons to appear before the employers in a case like this were their paid officials. In refusing to see the officials, the Committee had not shown any sympathy with Trade Union questions. This speaker was followed by Mr. Hollis, who moved, as an amendment, that the minute be referred back. He expressed the opinion that the Committee were very ill-advised in refusing to see the men's representatives. There was no one better able to deal impartially with a case of this description than the men who were not concerned inside with it. The majority of employers nowadays met Trade Union representatives; and there were many instances where grievances were settled by the employers and the officials in a satisfactory manner. The question of recognition was a sore point with the men when their representatives were not considered. In seconding the amendment, Mr. Skuse pointed out that it was not always desirable in the interests of the men for them to appear individually before their employers, especially in the presence of the officials who were over them.

Replying on behalf of the Gas Committee, Mr. Brewster remarked that the amendment had come rather late. In the first place, the Committee were asked if they would receive a deputation of stokers, and they said they would. The first day the deputation should have appeared, two men who had never asked that they should be received came to the door. They were the Secretaries of the Municipal Employees' Association, which represented all sorts of municipal employees. These two men had no personal knowledge of the gas-works. The Committee recognized that this was a new undertaking so far as it concerned the new retorts; and they were quite willing to confer with the stokers. It would be impossible for the Committee to deal with men who had never been inside a gas-works so easily as with the gas-workers themselves. They had always previously settled their grievances with the men direct. The Committee understood exactly what the men desired; and they had decided to consider their request at the next meeting. He thought that the amendment was entirely out of place, because the matter was under the consideration of the Committee. Mr. Linfoot practically admitted that he knew nothing of what he was talking about. He said that he had never been in the gas-works before, and did not know how the work compared with what was done under the old system. He could inform Mr. Linfoot that there was absolutely no comparison at all. The new retorts had done away with a large amount of laborious work; and all the men had to contend against now was the heat. Mr. Walker said there seemed to be an endeavour to give an impression that there was a kind of dispute on at the gas-works. There was nothing of the sort; there was not even a misunderstanding. He thought it was generally known throughout the Council and the town that the new retorts meant new conditions of labour; and until they had been tried, it was difficult to know exactly how they would work. But the Committee were endeavouring in every possible way to meet the men in a manner that would satisfy them, and in a way, too, that their friends would not have the slightest reason to complain of.

In reply, Mr. Linfoot said it was not a question of whether there was a dispute, but of whether or not the Committee were justified in refusing to acknowledge the Union officials. As to the men's deputation not understanding the business they had come about, one was an old municipal servant. He was a well-known man up and down the country, and was District Secretary of the Municipal Employees' Association, and was familiar with the details of the working of the undertaking referred to. He (Mr. Linfoot) could not pretend to understand every detail of the difference between the old and new retorts; but he had seen sufficient to convince him that, though they had adopted an improved system, yet the duties of the men were most arduous, and he was surprised that the Gas Committee refused to see the men's deputation.

The Chairman of the Gas Committee (Mr. Fernley) said they were quite as anxious to deal fairly with the men as any of the members who had just spoken upon the amendment. If they would follow the negotiations from the beginning to the end, they would find, with regard to the conditions under which the men were to work at the new retorts, that they were those which had been suggested by the men; and in this matter they had received every possible information from Mr. S. Meunier, the Engineer, as well as from other sources. In fact, with the exception of the week's holiday, the Committee had given the men all the conditions they asked for. The whole of the negotiations had been carried on through the men's own Society. The Society had not been ignored, as all the correspondence had been carried on through them; but the Committee had never had an application to see the men who wanted to appear before them with the deputation. Throughout, the negotiations had been of a most amicable character. If the Association had written and said the men preferred their representatives to appear before the Committee, he had very little doubt that the Committee would have been willing to receive them; but without making any request at all, they ignored the Committee, and simply appeared. He thought, therefore, that on this particular occasion the Committee could not be blamed for objecting to see them. The Committee had never disputed the principle of recognizing the Municipal Employees' Association.

On a vote being taken, after further discussion, the amendment to refer the matter back was lost.

VISIT TO THE NEWCASTLE GAS-WORKS.

What proved to be an extremely interesting visit was paid last week by the members of the Watch Committee of the Newcastle Corporation to the Redheugh Works of the Newcastle and Gateshead Gas Company. The party included the Lord Mayor (Mr. J. M. Oubridge) and the Chairman of the Watch Committee (Alderman John Goolden); while the Company were represented by the Chairman (Sir W. H. Stephenson) and other Directors, the Secretary (Mr. Thomas Waddom), the Engineer (Mr. W. Doig Gibb), the Distributing Superintendent (Mr. J. Lewis), and the Manager of the Redheugh works (Mr. T. Hardie). The visitors were divided into two parties—one conducted by Mr. Gibb and the other by Mr. Hardie. Commencing at the retort-house, the inspection proceeded until the purifiers were reached; and this was a portion of the plant to which attention was particularly drawn, owing to the fact that on the recent repeal of the sulphur restrictions the system was altered from lime to oxide. There have, it is stated, been complaints by the Corporation that the new process has resulted in an injurious increase of the percentage of sulphur compounds in the gas. Mr. Gibb explained that, while the amount of sulphur compounds had increased from 20 to 40 grains per 100 cubic feet, this was an infinitesimal amount, representing the difference between 15 and 20 parts in 1,000,000 parts of air. An incandescent burner, he said, consumed 5 cubic feet of gas an hour; so that it must burn for 20 hours to show the 40 grains of sulphur. They were obliged to extract all traces of sulphuretted hydrogen; but there had been difficulty in dealing with the sulphur compounds other than sulphuretted hydrogen. The old lime process was very erratic, and was bad for the workmen; and, with the oxide, they had a more certain process, and one which the men could work without danger.

After a complete tour of the works had been made, the party sat down to luncheon, under the presidency of Sir W. H. Stephenson. Among the toasts, Lord Armstrong proposed "The Corporation of the City and County of Newcastle-upon-Tyne." He said that the Corporation had always, whenever they could, supported the policy of the Company, and the Directors always strove to meet any suggestion made by the Corporation. He mentioned that the Lord Mayor began life in the service of the Gas Company. The Lord Mayor in response, said he was pleased to recognize the cordial relations that existed between the Corporation and the Company. Mr. E. A. Hedley proposed "The Watch Committee." He remarked that in 1886 the sale of gas to private consumers was 1,111,647,000 cubic feet. In 1896, it had increased to 1,839,881,000 cubic feet, or a growth of 65·46 per cent. In 1906, the sales had risen to 2,735,356,000 cubic feet, or an increase over 1896 of 48 17 per cent. The proportion of public lighting to private lighting was one-twelfth. The gas made in 1906 was 3,352,433,000 cubic feet, as compared with 2,518,614,000 feet in 1898; and the amount of coals carbonized in 1906 was 300,101 tons, as against 235,484 tons in 1898. The number of consumers in 1906 was 91,989, as against 37,052 in 1898. Economy, combined with taking advantage of all new processes, was the object of the Company and their staff. The Corporation, as the representatives of the ratepayers, should assist the Directors to give a cheap supply of gas. Out of every 6d. saved, the consumers got 5d., and the shareholders only 1d. In reply to the toast of "The Newcastle-upon-Tyne and Gateshead Gas Company," the Chairman said it had been a real pleasure to the Directors of the Company to welcome so large a contingent of the Newcastle Corporation as was represented by the Watch Committee. They felt that they had considerable obligations and responsibilities. They had had great powers conferred upon them; and, in the exercise of these powers, they were determined to do the very best they could, not only for their individual interests, but for the well being and advantage of the great community which they were called upon to serve. The area supplied by the Company included a population of more than half-a-million. In conclusion, he spoke of the indebtedness of the Directors to the members of the staff.

PRICE OF GAS AT LINCOLN.

Opposition to a Recommendation of the Committee.

Successful opposition was offered by members of the Lincoln City Council at the monthly meeting last Tuesday to a recommendation by the Gas Committee that the price of gas should be advanced from 2s. 1d. to 2s. 2d. per 1000 cubic feet from Oct. 1. Even the Committee themselves, it transpired, were not unanimous on the question, for an effort had subsequently been made by certain of the members to get the resolution to recommend the increase rescinded.

The Chairman of the Committee (Alderman Wallis), after pointing out that the chief reason for the proposal to raise the price was the increased cost of coal, remarked that the Committee had bought their coal for a year; and the extra cost on the twelve months from October would be about £3000. On the other hand, they hoped to receive about £1000 more from the sale of coke; and by the introduction of the new machinery in the retort-house they would save about £700 or £750. A rise of 1d. per 1000 cubic feet would bring in about £1200.

For this year, they had some extra expenses in regard to renewals—£323 for a new boiler, and £239 for a saturator; making a total of between £500 and £600. If an increase of 1d. per 1000 cubic feet was effected, they would at the end of the year be in somewhere about the same position as they were last year. He had always maintained, and thought it was generally the feeling of the Committee and the Council, that ratepayers and consumers should share in the profits.

A question having been asked and replied to, Mr. White said he thought Alderman Wallis had not placed the proper facts before the citizens. In 1901, the price of gas was raised 3d. in consequence of the advance in the price of coal; and subsequently it was reduced. Since 1898, the Gas Committee had paid £18,700 to the rates. Last year £4000 was paid to this purpose; and at the end of the present financial year, if they did not raise the price, he estimated they would have about £3000 to place to the rates. He thought the days of dear coal would soon be passed. Referring to the gas-works, he remarked that on the present basis they would belong to the citizens, free of debt, at the end of 28 years, and would be worth £250,000. Mr. Pennell pointed out that the £4000 given to the district rate last year by the Gas Committee amounted to something like a 6d. rate; and if the Committee did not furnish the city with an equal amount next year, the rates must go up 6d. If they were only to find £3000, the district rate would have to be increased to meet the deficiency. In the interests of the working classes, he thought it was better for them to pay 1d. increase in the price of gas than 1½d. more on the district rate. The Mayor (Colonel J. S. Ruston) said that, from the remarks made, it seemed to be plain that they would either have to have an increase in the price of gas, or an increase in the rates; but Mr. White remarked that he would not admit this, as he had figures which showed that the rates would not be increased even if the price of gas remained as at present.

Further speeches having been made both for and against the increase, a vote was taken on the Committee's recommendation, when it was decided, by 13 votes to 11, that the price of gas should not be raised.

PUBLIC LIGHTING IN PADDINGTON.

The Question of Gas or Electricity.

At the Meeting of the Paddington Borough Council last Tuesday, the question of lighting the Harrow Road by electricity or gas, which was brought up and adjourned at the meeting of the Council just before the recess, was again under consideration. It may be remembered that the Works Committee of the Council reported that a deputation appeared before the Council in February last with reference to the better lighting of the thoroughfare named; and that a memorial signed by nearly 200 ratepayers was read in support of the representations then made. The Committee had some experiments carried out with improved gas and electric arc lamps; and the Borough Surveyor submitted the following schemes for lighting a section of the road: Existing lamps replaced by two-light No. 4 Kern burners—(1) initial cost £130, (2) annual cost £280; replaced by two-light inverted burners, (1) £190, (2) £310; by three-light do., (1) £220, (2) £390; by five-light do., (1) £280, (2) £650; by six-light do., (1) £380, (2) £790. The Committee decided to recommend that the portion of the road specified should be lighted by 24 electric arc lamps, alternate lamps to be extinguished at 12.30 a.m., at £264 per annum, *plus* £10, the initial cost of the alterations to some of the existing lamp-columns, as against £190 per annum for lighting with the present lamps at the increased cost of gas; and that an agreement on these terms should be signed for ten years with the Metropolitan Electric Supply Company, Limited. Commenting upon the foregoing proposal, the Finance Committee pointed out that it opened up the question of electric light for the whole borough, which would involve the Council in additional expense. After some discussion, the recommendation of the Works Committee was referred back for further consideration. Last Tuesday the Committee reported that they had further considered the matter, and saw no reason to alter their recommendation.

Mr. Blackwood proposed—"That the question of electric light in the Harrow Road be postponed for the present, and that it be referred to the Works Committee to consider the question of improving the street lighting there with incandescent gas-mantles."

Mr. Fairbank seconded the motion, and spoke in favour of improved gas lighting. He said the whole question of gas *versus* electricity had been fought out in the Council three or four years ago. If electricity was introduced in a portion of the Harrow Road, it would have to be extended all the way to Queen's Park. Other roads were equally deserving of attention. It was noticeable that the very men who were proposing electricity fought against it on a previous occasion; and the Council decided upon gas. It had been said that it had proved a failure; but he denied it. What he held was that gas was inadequate for some of the main thoroughfares. Why should they not put in twin or triple burners, as in other boroughs? He submitted that instead of still further wasting the ratepayers' money on the electric light, and carrying out the extravagant proposal of the Committee, they should improve the existing gas system. He hoped the proposal would be dropped until they could get electric light at a price more commensurate with the financial resources of the community.

Alderman Whur, in supporting the recommendation of the Committee, remarked that if the electric light proved a failure at the end of three years, they could go back to gas. On the other hand, if they increased the number of gas-burners, they would at once have to spend moremoney.

Mr. Waycott said the Council could put on some extra gas-burners at a cost of £130; and if they were not satisfied, the matter might be brought up again after the winter.

The Council then divided on Mr. Blackwood's proposition, and it was carried by 32 votes against 11.

The Directors of the Primitiva Gas and Electric Lighting Company of Buenos Ayres have declared an interim dividend of 2s. 6d. per share on the ordinary shares.

ELECTRIC LIGHTING OF MONMOUTH.

Nearly £5000 lost in Seven Years.

Last Thursday, Mr. H. R. Hooper, M.Inst.C.E., one of the Inspectors of the Local Government Board, held an inquiry in the Shire Hall, Monmouth, into an application made by the Monmouth Town Council to borrow £10,000 for the purpose of defraying expenses already incurred in connection with the electric lighting undertaking. In opening the proceedings the Inspector urged that Monmouth was in a financial difficulty, and declared that the Council must face facts.

After formal evidence had been given, it was stated that the assessable value of the borough for the general district rate amounted to £19,794; and that the outstanding loans under the Sanitary Act amounted to £31,355. The Inspector pointed out that they must know exactly the amount of the unauthorized loan, and what had been sanctioned, expended, or overdrawn. It was explained that Lord Llangattock had acted as a guarantor to the bank for the loan of £10,000 to the Council; and that this money had been spent, but nothing paid back. The financial position of the borough was gone into minutely. It appeared that the limit of the borrowing power of the Corporation would allow of £8232 being raised; and application was made that the repayment for any amount should cover as long a period as possible.

The Inspector pointed out that the scheme for drainage and electric lighting in Monmouth was a combined one. He explained that the Local Government Board had informed the Monmouth Corporation that they would not be prepared to sanction further borrowing powers for electric lighting until the sewage scheme was working in an efficient manner. Commenting upon the amount of unauthorized borrowings of the Council, the Inspector said he must know how they were incurred. The matter of excessive expenditure had not been properly put before the Board. Apparently no attempt had been made by the Corporation to pay back the £10,000 loan for which Lord Llangattock favoured the Council by becoming guarantor.

In dealing with the electric light accounts, it was stated that the whole of the expenses incurred in this department amounted to £17,836—quite double the estimate. In one instance, the Inspector held that in the building charges there had been wrong allocation. This could not be explained by the Town Clerk or the Borough Treasurer. The former promised to get out a written statement. The Inspector said he had come to inquire into the matter, and the evidence must be given. He pointed out that in seven years the electric light undertaking in Monmouth had managed to lose £4887. (Cries of "Shame.") This meant 8½d. in the pound each year since it started; and yet the object of adopting it was to effect a saving of 7d. in the pound.

The inquiry was adjourned till the 5th prox.

Commenting upon this matter, the "Western Mail" last Friday said: "Thanks to municipal trading, Monmouth is in a very bad way financially. The Local Government Board Inspector who was sent down to inquire into an application to borrow £10,000 found it necessary to speak very plainly with reference to the electric light undertaking. Started originally with the object of saving the ratepayers 7d. in the pound, this precious undertaking has been run for seven years at a loss of £4887; and instead of saving the ratepayers 7d., it has cost them 8½d. in the pound. The assessable value of the borough is only £19,794; and this figure is very nearly doubled by the indebtedness. What folly prompted the Monmouth Corporation to embark upon this electric lighting scheme, we cannot conceive; but its disastrous failure should act as a warning to all other small municipalities. Many a little town cherishes ideals of public ownership far too big for it. The ambition of the Mayor and Corporation of a small borough to rise out of the drab level of every-day existence, and control big enterprises on behalf of the ratepayers, is easy to understand. As in Monmouth, this ambition generally overleaps itself. It is satisfactory to note the keen spirit with which Local Government Board Inspectors are inquiring into the applications for municipal loans. This is an indication that the Government are alive to the fact that the reckless extravagance of municipalities is becoming a grave national danger. We hope they will find a way of putting an effective stop to it."

HALIFAX CORPORATION WATER SUPPLY.

Inauguration of the Walshaw Dean Reservoirs.

The new water-works of the Halifax Corporation at Walshaw Dean (a valley lying on the moors beyond Hebden Bridge, at an altitude of more than 1000 feet above sea-level) were formally opened last Tuesday by Mr. Mark Crossley, the Chairman of the Water Committee, and the Vice-Chairman, Alderman W. Brear, the latter of whom, while holding the office of Mayor, cut the first turf in September, 1900. The ceremony was witnessed by about 300 persons specially invited to the function, and a fair number of the general public. The guests included the members of the Town Council, local Magistrates, the Mayor of Brighouse (Alderman W. Smith), the Chairmen of seven neighbouring District Councils, and Corporation officials. The large party were conveyed from the Town Hall in waggonettes and carriages; and their destination was reached about midday. The proceedings were under the direction of the Mayor (Alderman R. D. Ward); and they occupied only about half-an-hour. Mr. Crossley and Alderman Brear were each presented by the Engineers (Messrs. G. H. Hill and Sons) with a silver cup, as a memento of the occasion. Then Mr. Crossley opened the door of the tower, and Alderman Brear turned a large wheel inside, by which the water from the middle reservoir is released into the lower one. A vote of thanks was accorded to these gentlemen for their services on the Water Committee, and the proceedings concluded. The return journey was commenced at one o'clock. In the afternoon, luncheon was served in the Co-operative Hall, Hebden Bridge, under the presidency of the Mayor. The toast of "The Chairman and Vice-Chairman of the Water-Works Committee" having been honoured and

acknowledged, Alderman B. Firth proposed, "The Engineers and Contractor." Mr. G. H. Hill, in responding, said that the available daily supply of water from the Walshaw Dean works would provide 80,000 people with 30 gallons a day. He thought the Corporation had been wise in securing the Widdop and Walshaw Dean valleys; for if they had left the latter, some other town would have possessed it to-day. The new works were substantial, and, so far as he knew, would give complete satisfaction, though they had not yet been tested to the top water-level. Mr. Enoch Tempest (the Contractor) also responded. The other toast was "The Visitors," submitted by Alderman Calvert and acknowledged by the Mayor of Brighouse and Mr. Basil Lipscombe, the Agent for Lord Savile. The Chairman, in bringing the function to a close, expressed his pleasure at seeing present the Chairmen of the neighbouring District Councils.

The reservoirs just completed constitute the last stage of a scheme for increasing the water supply of Halifax and the district, which first received parliamentary sanction so far back as 1868. The large reservoir in the adjacent valley of Widdop and the necessary aqueduct for conveying the water into the district of supply were the first portion; and the construction of these works was completed in 1878. The parliamentary powers for Walshaw Dean were renewed periodically; and about ten years ago, after a time of excessive drought, a keen controversy raged on the question of advantage being taken of them. The result was that on Sept. 21, 1898, the Town Council decided to proceed with the works. The contract was given to Mr. Enoch Tempest, of Manchester, and operations were begun in 1900. The reservoirs are three in number, and can be connected and disconnected as needed. Their total capacity is 610 million gallons; and after nearly 1¼ million gallons per day have been delivered into the stream night and day continuously as statutory compensation, there will be available for the Corporation a supply of 2½ million gallons a day. Going from the lower to the upper reservoir, the top water-levels are 985 feet, 1043 feet, and 1100 feet; the heights of the embankment are 76 feet, 77 feet, and 75 feet; and their lengths 225 yards, 290 yards, and 250 yards. Moorland, 2300 acres in extent, comprises the drainage area; and, being free from any source of pollution, the supply of water is of exceptionally good quality, bacteriologically speaking. The earthwork used in the embankments amounted to about 350,000 cubic yards, in addition to which large quantities of masonry, concrete, and clay were employed. Of the 120,000 cubic yards of clay used in the puddle walls, the greater part was brought from the adjacent land of Lord Savile, from whom much valuable assistance in the way of facilities had been received. Discharge-tunnels and valve-shafts have been constructed at each reservoir; and provision has been made for drawing off the water at different levels. A watercourse about 1¼ miles long has been constructed from the upper end of the valley, in order to divert floods straight into the lower reservoir, out of which the compensation water will be taken. With the addition of the Walshaw Dean reservoirs to their system, the Corporation have an available supply of 8 million gallons of water daily. Their water-works system now covers the whole of the gathering-ground from Thornhill to Bouldsworth Hill, near the Lancashire border, and may be reckoned as one of the finest in the country. The appearance presented by the reservoirs last Tuesday was an imposing one, though they contained comparatively little water. The distance of the water from what is described as their top level was 13 feet in the upper reservoir, nearly 26 feet in the middle one, and 34 feet in the bottom one. The cost of the new reservoirs up to date was stated to be £323,739. But it will not be until the end of the year that the trimming and cleaning up of the works will leave them in a finished condition; and then there will remain for settlement the claim of the Contractor for £77,000 in extras. These facts make the ultimate cost uncertain; but in many quarters it is thought it will not be less than £350,000. The original contract amounted to £172,335, though to this was afterwards added £2000 for extra beaching on the sides of the reservoirs and £8000 for the removal of peat from the beds—making a total of £182,335. The main reason for the disparity between the estimate and the actual expenditure is the great depths to which excavations have had to be carried to find a water-tight foundation for the three puddle walls—in some cases almost three times what were expected would be necessary.

SWANSEA CORPORATION WATER SUPPLY.

Opening of the Cray Water-Works.

Last Wednesday, the extensive water-works of the Swansea Corporation at Cray were formally inaugurated by the Mayor (Mr. David Harris). He was presented by Mr. E. P. Hill, of the firm of Messrs. G. H. Hill and Sons, the Consulting Engineers to the Corporation, with a gold key, with which he opened the valve-house. It bore the following inscription: "Presented to Councillor David Harris, Mayor of Swansea, by Messrs. G. H. Hill and Sons, Consulting Engineers, on the occasion of the opening of the Cray Reservoir, Oct. 2, 1907."

The reasons which determined the selection of the River Cray as the best available source of supply were the heavy rainfall, the great elevation, the fact that the site was devoted to mountain pasture (with only two shepherds' cottages), and the good facilities for the construction of the works. The watershed consists of 2640 acres of excellent gathering-ground in the wettest portion of South Wales. Parliamentary powers were obtained as long ago as 1892; but when the Bill was passing through Committee, clauses were imposed by which a water authority, any part of whose district is within a mile of the main pipe-line, may demand and obtain a supply for their requirements—leaving a prior right to Swansea of 25 gallons per head. The authorities referred to include the whole population of the Swansea Valley and the Swansea district; and at the present time it numbers about 60,000 people.

The storage reservoir contains 1000 million gallons of water. It is about 100 acres in extent; being 1¼ miles long and ½ mile wide. The top water is 1000 feet above sea level; and the water is impounded by a dam 1250 feet long and 144 feet deep from the foundation to the top of the bank. The depth from the overflow to the surface of the rock at the old river course is 100 feet, and the rock excavation in the centre of the dam is 37 feet deep. The overflow water from the reservoir passes over a granite weir crest 200 feet long, and down the back of the dam. This unusual length is provided to meet the violent floods which occur in the valley, due to the steepness of the surrounding hills, the water-tightness of the ground, and the very heavy rainfall. A roadway is carried along the top of the dam, and crosses the crest of the overflow on a series of brick arches. Compensation water to the extent of 1½ million gallons per day is discharged through the 3-feet pipes into the Cray for use by the riparian owners and fishing interests on the Cray and the Usk.

The reservoir not being in the natural drainage area of Swansea, it was necessary to devise a tunnel, commencing at the bottom of the reservoir and terminating in the watershed of the River Tawe, which passes down to the town. This tunnel is about 3 miles long, and was principally driven from the south (or Swansea) end, and from a working shaft on the reservoir ground, or north end—these points being about 2300 yards apart. This tunnel is internally 5 feet high and 3 ft. 6 in. wide. The water flowing from the reservoir through the tunnel is regulated in a valve tower placed at the west side of the reservoir. The upper valves are 24 inches in diameter, in duplicate, and are of the roller-bearing kind. After the water has gone through the tunnel, it emerges in a gauge basin, where screens are provided, after passing through which the water enters the mains to Swansea.

At present one main has been laid complete, which discharges 2½ million gallons of water per day into a service reservoir at Townhill, 586 feet above the level of the sea, immediately overlooking the town of Swansea. This main is 2¾ miles long. A second line of pipes is now in contemplation, which will deliver water to a height of 350 feet above Ordnance datum into a service reservoir to be constructed. The works were designed by Mr. R. H. Wyrill, the Borough Engineer; and their cost to date is £548,483.

WATER SUPPLY OF EAST DENBIGHSHIRE.

Inauguration of a New Reservoir.

Last Wednesday, a new reservoir which has been constructed at Ty-Mawr, near Rhos, by the Wrexham and East Denbighshire Water Company, was formally inaugurated by the Chairman (Mr. J. Allington Hughes), in the presence of members and officials of various local authorities; the name-plates on the reservoir being unveiled by the Mayor of Wrexham (Mr. Edward Hughes). The Company's Engineer (Mr. F. Storr) furnished some particulars in regard to the nature of the undertaking, of which the following is a short description: The reservoir, which was authorized by the Company's Act of 1902, is constructed on sidelong ground adjacent to the Pentrebychan Brook. It is formed partly by excavation and partly by an embankment which extends round three sides. The total length of the embankment, including the north and south flank banks, is 2473 feet. The maximum depth of bank from the original surface of the ground is 43 feet. The width at the top is 20 feet, and the maximum width at the base 228 feet. In the centre of the embankment is a wall of puddle clay, carried well down into a thick bed of boulder clay, which extends over the whole site. The puddle wall varies in thickness from 4 feet at the top to 12 feet at the ground level. It narrows as it is carried down; the maximum depth below the surface being 56 feet. At the mouth of the tunnel are placed the sluices controlling the flow of water to the reservoir; so that in the event of floods, turbid waters may be excluded and sent down the brook. The water area of the reservoir is 23¼ acres, the maximum depth 36 feet, and the capacity 135 million gallons. The works were commenced in the summer of 1903 with the diversion of the road and footpath which crossed the site of the centre embankment; and they have been carried on to completion by the Company's own staff.

At the conclusion of the ceremony, the guests were entertained at luncheon, after which several toasts were duly honoured. In submitting that of "The Wrexham and East Denbighshire Water Company," the Mayor of Wrexham said the inhabitants of the district supplied by the Company had cause to congratulate themselves upon the excellent supply of water which the opening of the new reservoir would afford them. The water in the Wrexham district was of the purest; and he offered the Company sincere congratulations on the successful completion of the new works. Mr. J. Allington Hughes having acknowledged the toast, Mr. Storr also responded. He said the daily supply from all the Company's reservoirs amounted to 750,000 gallons, and up to date the Company had spent £192,000 in providing the supply. The best asset in a water company was a contented and well-served body of consumers; and this asset, he ventured to say, the Wrexham and East Denbighshire Water Company possessed. "The Mayor and Corporation of Wrexham" was submitted by Mr. H. Croom Johnson, and acknowledged by the Mayor and Alderman Thomas Jones. The concluding toast was that of "The Neighbouring Water Companies," submitted by Mr. Arthur E. Evans, and responded to by Mr. Frank Roberts, the Chairman of the Chester Water Company, and Mr. H. Dyke Dennis, the Vice-Chairman of the Ruabon Water Company.

Gas-Workers' Dispute at Tredegar.—The Tredegar Urban District Council, after due consideration, have rejected demands put forward by Mr. W. V. Morgan, the local Secretary of the Gas Workers' Union, on behalf of the men employed in the gas-works. The men demanded time-and-a-half for Sunday labour, and the fixing of 2 tons of coal for each man to carbonize during an eight-hour shift. The Manager (Mr. W. W. Davies) objected to both these demands, and as an alternative for the latter suggested that each man should be required to produce 20,000 cubic feet of gas in an eight-hour shift. The argument against this used by the Union official was that the Manager might introduce coal of an inferior quality; and the responsibility of production would be placed on the men. Such a system, Mr. Morgan stated, was not in vogue in any Union gas-works in South Wales.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held their first monthly meeting for the winter on Monday last. The Treasurer—Mr. John S. Gibb—submitted estimates of the income and expenditure for the current year, based on the actual figures for the past year. The probable income from the sale of gas—1,931,300,000 cubic feet—he stated, was arrived at by the Engineer taking the gas estimated to be sold during the summer survey at 2s. 9d. per 1000 cubic feet (the old price) and thereafter from the date of fixing the new price at an increase of 3d. for gas sold to ordinary consumers within and without the city and burgh boundaries. It was not proposed to alter the rate on gas supplied by prepayment meters; and the gas supplied for public lamps would come up for readjustment in April, 1908. His estimate for the sinking funds proceeded on the basis of the minimum statutory allowances of 15s. and 20s. per cent. being set apart for the annuities sinking fund and the mortgage sinking fund respectively, and 5s. per cent. for the reserve fund, as prescribed by the Commissioners' Provisional Order. On the year's estimated output, 1d. per 1000 feet represented £8047. The estimated probable deficit on the year's working was £4993. The revenue from gas was estimated for the period from May till now at £76,112; and from now to May, 1908, at £164,217; from consumers beyond the burgh boundary, at £2742 and £2758 respectively; from prepayment meter consumers, at £10,768; from stair lights, at £10,899; and from public lamps, at £9131—a total of £279,627. The actual revenue from gas in the past year was £265,181. Coke was estimated to produce £31,770, as compared with £24,632; gas tar and oil gas tar, £13,773, as compared with £13,413; and sulphate of ammonia, less working expenses, £20,119, as compared with £21,145. The total revenue was estimated at £346,129—as compared with £325,222. On the expenditure side, coal (178,492 tons) was estimated to cost £132,763, as compared with £104,000; gas oil £4590, as compared with £2800; salaries, wages, and charges at works, £25,372—the actual cost last year; purifying materials and wages of purifier men, £1850, the same as last year; and repairs of works and plant, £22,435, as compared with £24,254. The total cost of the manufacture of gas was estimated at £187,010, as compared with £158,278. Distribution of gas was estimated to cost £23,932, as compared with £24,936; management, £1100, as compared with £10,654; feu duties, £600; rates and taxes, £15,530, as compared with £15,518; pensions and allowances, £1600, as compared with £1541; accidental damages, £4000, as compared with £3770; law and parliamentary expenses, £1800, as compared with £1891; discounts and bad debts, £7000, as compared with £6913; annuities, £32,800, as compared with £32,828; interest, £42,500, as compared with £42,083; annuities sinking fund, £9350, as compared with £9338; mortgage sinking fund, £12,100, as compared with £12,065; reserve fund, £1000, as compared with £909; and expenses of mortgages, £900, as compared with £910. The total expenditure was thus estimated at £351,122, as compared with £325,222, and leaves the anticipated deficit of £4993. The Works Committee, having approved the estimates, recommended that the price of gas be raised by 3d. per 1000 cubic feet, making it 3s. to ordinary consumers within the boundaries, and 3s. 6d. beyond; and that consumers by prepayment meters should continue to be charged 4s. 2d. per 1000 cubic feet. These recommendations were adopted without comment.

It was reported that the Assessors had valued the undertaking of the Commissioners for the current year at £94,465—as against £86,840 last year.

Mr. John Wilson, K.C., the learned Sheriff of Inverness, Moray, and Nairn, has given his decision in the application to him with reference to the erection of a new gasholder at Elgin, to which I have had occasion to refer more than once recently. His decision is final, and not subject to review. As might have been expected, he has decided in favour of the Town Council, who may now proceed with the erection of the gasholder according to their own will or requirements. The Sheriff expresses the hope that it may be found possible to lower the foundation for the tank, so as to lessen the height of the holder above ground. The attitude of the Town Council has been so conciliatory all through the proceedings, that there can be little doubt that they will give effect to the expressed wish of the Sheriff. The important point of the decision—a report of which will be found in another column of the "JOURNAL"—is that it fixes the practice of the Law Courts in such applications, confirming, as it does, the decision of Sheriff Cheyne in the Gourock case in 1895. The two decisions emphatically settle that gasholders may be planted in any locality without danger to surrounding inhabitants or properties. A discretion has been given to Sheriffs to refuse to allow any gasholders to be erected, if against the wishes of immediate neighbours. But both the Judges who have had to deal with such cases have acknowledged that the objections, in order to be given effect to, must be reasonable; and in their opinion, if the locality be a suitable one, objections founded upon considerations of amenity, or obstruction to view, are not to be entertained. These two decisions are sufficient for the guidance of any Judges who may, in future, be called upon to decide similar applications, and are also enough to give assurance to owners of gas undertakings that, if they put forward reasonable proposals, they will be in no danger of being barred by such objections as have been already held to be insufficient.

In the Elgin Town Council on Monday, Treasurer Black, in submitting the accounts and estimates in connection with the public departments of the Corporation, said there had been an increase in the make of gas of a million-and-a-half cubic feet during the past year. This was not quite so much as in the previous year; but still they had to congratulate Bailie Gordon, the Convener, on the progressive state of matters in the gas-works.

The work of the Scottish Junior Gas Association for the session was begun this afternoon by the holding, in Edinburgh, of the annual meeting of the Eastern District. A satisfactory state of matters was reported, and a very hopeful view of the immediate future was taken. The business of the session has all been arranged for, which reflects

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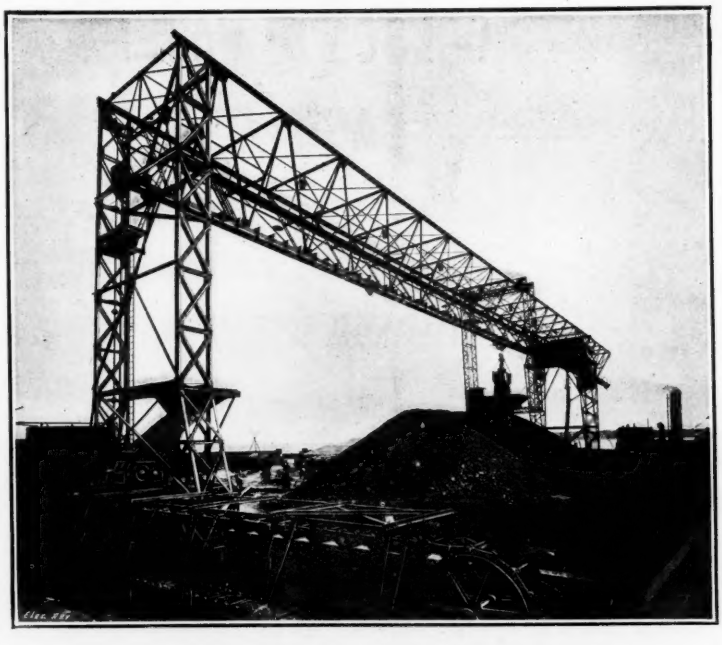

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credit both upon the officials, for their attention to duty, and upon the members for their readiness to respond. The syllabus has not yet been published ; but I understand that, in addition to the quarterly meetings for the reading of papers and discussions, there will be four visits to works—these including one, this day fortnight, to a colliery at Bathgate, visits to the Perth and the North Berwick Corporation Gas-Works, and a visit to the Gothic Works of Messrs. R. & A. Main, Limited, at Falkirk. The meeting had no technical work before it except the address of the new President—Mr. D. Bisset, of Granton. The district have declined to go beyond their own borders with their work, in their resolutions not to seek any change in the examinations for the London Institute, not to seek recognition at the hands of the Senior Association, and not to attend the meeting of Gas Associations in Manchester. The members of the Eastern District of the Scottish Junior Association do not belong to the order of individuals who have a mania for organization. They are doing good work in their own locality ; and they are content to go on doing so. They are willing that wider questions as to the general policy of gas supply should be left to those who are in the thick of the business ; and, as the Junior Association is pre-eminently a body for the educating of young men so as to fit them for the more active work of seniors in days to come, it is easy to concede that the stay-at-home policy is the more consistent with their general purpose.

It is almost with a feeling of regret that one hears that the Oil-Gas Enrichment Company, Limited, which was formed to promote oil-gas patents of the late Mr. W. Young, of Peebles, is to be wound up. But, of course, the Company have nothing now to be kept in existence for. The patents which they held have expired ; and there will be no more revenue from them. For a number of years past there has been no new business—a condition of affairs which it was easy to have foreseen. The funds of the Company have been—it is to be presumed because of the lack of other outlet—invested in securities which were quite ample at the time, but are not so now. This is to be regretted, because there will be a loss to the shareholders, and particularly to Mr. Young's Trustees, who are the largest holders of the deferred stock.

The Grangemouth Town Council have, on the recommendation of the Gas Committee, decided to retain the price of gas at 3s. 4d. per 1000 cubic feet.

The Town Council of Lerwick have adopted the Burghs Gas Supply (Scotland) Act of 1876, in order to place the members in a position to carry on negotiations with the Gas Company for the acquisition of their undertaking.

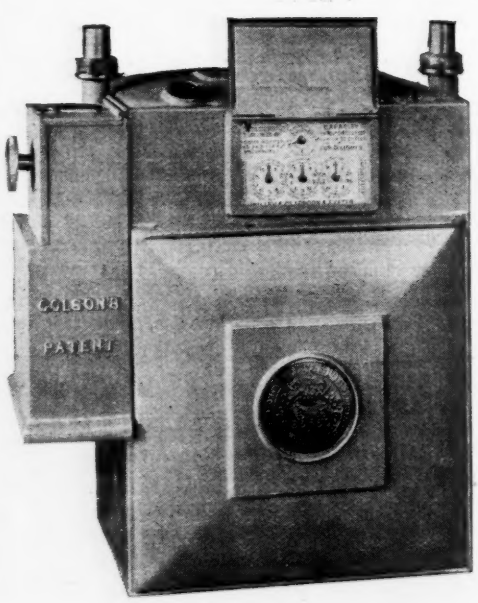
The burgh accounts for the year were submitted to the Peterhead Town Council on Monday. Among them was the statement, relative to the gas undertaking, that the revenue amounted to £7695, of which the principal items were : From the sale of gas, £6101 ; from residual products, £1534 ; and from rents, £60. The expenditure amounted to £5258, of which the manufacture of gas accounted for £4470, distribution for £185, rents, rates, and taxes for £485, and general administration for £118. The balance carried to net revenue account was £2437. The total liabilities of the gas undertaking stand at £21,162, and the assets at £23,775 ; the surplus being £2613. During the year there was expended, on capital account, for the provision of new plant, the extension of mains, and the purchase of gas-stoves, £1146. In his report, the Auditor said he had not had sufficient evidence that the expenditure charged to capital account had been so charged properly. Consideration of the accounts and the Auditor's report was deferred till an abstract of them had been printed.

In the Fraserburgh Town Council yesterday, a letter from the Manager of the Fraserburgh Gaslight Company was read, in which permission was asked to lay a gas-main between the gas-works and a new gasholder. A Committee recommended that the permission asked be granted, the work to be done under certain conditions and restrictions, and the thoroughfares interfered with to be maintained by the Gas Company for twelve months after the completion of the work. The recommendation of the Committee was adopted, on a division, by twelve votes to three.

The annual meeting of the Banchory Gaslight Company, Limited, was held on Tuesday. The report of the Directors showed a net profit for the year of £182. The Chairman—Mr. A. Ewan—referred, in complimentary terms, to the valuable services rendered to the Company by Mr. G. C. Sharp, the Secretary and Treasurer. He also warmly congratulated Mr. R. Forrest upon his successful management. A dividend at the rate of 1s. 3d. per share was declared.

The question of the insurance of employees against claims under the last Workmen's Compensation Act has not been much discussed of late. It was before the Town Council of Glasgow on Thursday. A Committee recommended that the Council remit to the Standing Committees of the several departments, with powers, during the first year of the operation of the Act, either to insure against liability in respect of accidents to their workmen, or to resolve that the risk of such accidents be undertaken by each of the various departments interested. It was moved, as an amendment, that the risks under the Act be borne by the Corporation itself, each department paying annually into a fund the premium which would have to be paid to cover the risks with a first-rate insurance company ; that all claims be met out of that fund, and the rates of contribution increased or diminished from time to time in accordance with experience ; and that it be remitted to the Committees to adjust and submit for approval the rates to be paid by the various departments. The recommendation of the Committee was adopted by a very large majority.

Kenilworth Water Company.—The annual meeting of the Company was held last Saturday—Mr. G. M. Turner presiding. The report of the Directors set forth that the amount available for disposal was £1006. It was proposed to deal with this by paying a dividend of 6½ per cent., free of income-tax, adding £150 to the reserve fund, and carrying forward £366. The Chairman, in moving the adoption of the report, stated that there had been increased expenditure during the year on repairs and rates, while the inside of the water-tower had been repainted. The report was adopted.



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CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Oct.* 5.

The market has been in a fairly sound condition during the week, a number of direct orders having been received. There has consequently been no difficulty in disposing of the parcels which have been offered; and though the production is now extending, the demand has been sufficient to maintain values. Quotations are £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool; and while at Leith makers are asking £12 2s. 6d. per ton, buyers do not so far appear to have gone beyond £12 per ton. In forward delivery, buyers have not come up to makers' views, which remain £12 2s. 6d. to £12 5s. per ton, according to position.

Nitrate of Soda.

This article is quiet but steady at 11s. 1½d. to 11s. 4½d. per cwt., according to quality.

Tar Products. LONDON, *Oct.* 7.

The markets for tar products remain in about the same position. Pitch is decidedly quiet, especially for prompt delivery. Buyers, both in South Wales and on the Continent, appear to be fully bought for this year's delivery, and also well covered for January-June. Business is reported to have been done on the east coast at prices varying from 24s. 6d. to 25s. per ton; and at the latter figure, a fair amount of business has been done. It is stated that 25s. 6d. has been accepted on the east coast for delivery all over 1908. The large London manufacturers are well sold, and practically out of the market, but probably some quantity of London pitch might be bought at 26s. per ton for prompt delivery. Creosote is very firm. Some quantity of one of the smaller London makes has been sold at 2⅞d.; but most manufacturers ask 3d. per gallon. In the Midlands, manufacturers ask 3d. to 3⅛d.; but in the North, it is possible to buy at figures varying from 2⅞d. to 2⅞d. Benzol, 90 per cent., is quiet. Business has been done for prompt delivery in London at 8½d. per gallon, and in the North, at 8d. Benzol, 50-90 per cent., and toluol are both neglected. Solvent naphtha is quiet. Business has been done in the North at 1s. per gallon; and in London, at 1s. 1d. Carbolic 60's are steady, though Continental consumers do not seem very eager to purchase at present. Crystals are quiet, and difficult of sale. No business is reported in anthracene.

The average values during the week were: Tar, 15s. to 20s., *ex* works. Pitch, London, 26s. to 26s. 6d.; east coast, 25s.; west coast, 24s. to 25s. Benzol, 90 per cent., 8d. to 8½d., casks included; 50-90 per cent., 8½d. to 9d., casks included. Toluol, 10d. to 10½d., casks included. Crude naphtha, 4d. to 4¼d., naked; solvent naphtha, 1s. to 1s. 1d., casks included; heavy naphtha, 1s. 1d. to 1s. 2d., casks included. Creosote, London, 2⅞d. to 3d., naked; North, 2⅞d. to 2⅞d., naked. Heavy oils, 3⅛d. to 3⅛d., naked. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8½d., casks included. Naphthalene, £6 10s. to £10 10s., packages included; salts, 35s. to 45s., packages included. Anthracene, "A" quality, 1½d. to 1¾d., casks included.

Sulphate of Ammonia.

This article is steady, and markets appear to be slightly firmer all round. Business is reported to have been done in London for ordinary makes on Beckton terms at £11 13s. 9d. and £11 15s.; while the principal London Gas Companies maintain their price of £12 2s. 6d. for prompt, and £12 5s. for forward, delivery. In Leith, though most buyers refuse to pay more than £12, manufacturers decline to accept this figure, and report having realized £12 2s. 6d. for prompt. In Hull, the best makes have been sold at £11 17s. 6d.; while £11 16s. 3d. is said to have been paid for some stuff of inferior quality. In Liverpool, business is reported at £11 17s. 6d. to £11 18s. 9d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The coal trade of the county continues unaltered. Ample orders are in hand for steam, shipping, and house qualities at prices which were fixed on Sept. 1, and which, up to the present, show no change. There has been more inquiry for gas coal and cannel. The following list of prices at the pits in this county will show the state of the trade: Best house coal 15s. to 16s. 6d. per ton, secondary 14s. to 15s., common 12s. to 13s. 6d., burgy 10s. 6d. to 11s. 4d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., lower qualities 7s. 9d. to 8s. 4d., shipping coal, f.o.t. at Garston, 13s. to 14s. 6d. Furnace coke is fetching high prices.

Northern Coal Trade.

There has been a better demand for coal the last few days; and the shipments from the north-eastern ports are heavier, both to British and foreign ports. There is rather more pressure to get shipments sent off to the Baltic before the close of the season; and thus there has been greater activity. Best Northumbrian steam coals are quoted from about 15s. 9d. to 16s. per ton f.o.b., second-class steams are about 15s., and steam smalls are generally firm at from 10s. to 10s. 6d. Gas coals are steady; and while the export inquiry is maintained, there is the growth in the home demand that is usual at this time of the year. Durham gas coals vary in quotation from about 14s. to 15s. 9d. per ton f.o.b., with perhaps a slightly higher price for best Wear gas kinds. There are not many contracts now in the market, but sales are in course of negotiation over the first six months of next year. The quieter appearance of the coal trade now makes buyers rather more reluctant to give the high prices that are asked for good gas coals. Coke is a little easier; and this affects gas coke. The current quotation for gas coke is from 19s. to 19s. 6d. per ton f.o.b.—the output showing a weekly increase.

Scotch Coal Trade.

Trade has been fairly active. The demand for shipping still holds, and prices are maintained. Small coal seems to be accumulating. The prices quoted are: Ell 14s. 6d. to 16s. 6d. per ton f.o.b.

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Recent Testimonial Church Lighting.

The Willenhall Gas Co.,
Gas-Works, Short Heath,
Nr. Wolverhampton.

Messrs. THE PNUEMATIC GAS LIGHTING Co., Ltd.,
36, Farringdon Street, London, E.C.

DEAR SIRS,

With further reference to your work in connection with the lighting of St. Giles' Church, Willenhall, I am glad to say the system continues to give "Entire Satisfaction." During the nine months it has been installed, the mantle renewals have averaged only one per burner and the Gas Consumption shows a reduction of 69 per cent. I am sending you a Photo. which I took this week, shall be pleased to show anyone the installation who wishes to see it.

Yours faithfully,
W. G. S. CRANMER,
Engineer and Manager.

St. Giles' Church, Willenhall.

A few recent Installations—

Madame Tussaud's, London,
London County Council Fire Station,
New Council House, Smethwick,
St. Patrick's Cathedral, Auckland, N.Z.,
St. Paul's Church, Oswaldtwistle, Lancs.,
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Telephone 2123 HOLBORN. Telegrams: "OMNIBUSSES, LONDON."

Glasgow, splint 15s. to 16s., and steam 14s. 3d. to 14s. 6d. The shipments for the week amounted to 324,358 tons—an increase of 33,174 tons upon the previous week, and of 16,193 tons upon the same week of last year. For the year to date, the total shipments have been 10,969,388 tons—an increase of 675,715 tons upon the corresponding period of 1906.

Some Pertinent Questions as to Coalite.

The publication in the "Manchester Guardian" early last week of the claims in the American specification for coalite which will be found in another part of the "JOURNAL," brought from a Manchester firm the following letter: "We notice in your columns a description of the process by which it is proposed to produce coalite. We should be glad if any of your readers could inform us wherein lies the difference between the process described and that pursued by every gas-works in the country, the resulting residuum being hitherto called 'coke.' If it is answered that coalite is to be removed from the retort slightly earlier than is usually the case in gas-works, surely there is nothing to prevent these already-instituted works from emptying their retorts a little earlier or later, as they may think fit, should it be deemed desirable in order to satisfy any wants of their customers. Hitherto coke—a good saleable material—has been the residuum. Now it would appear, in the case of coalite, that gas is to be the residuum. How is this to be disposed of? Are we to have a competitor to our municipal undertakings? Such a thing is, of course, out of the question; so that the price obtained for the material itself, coalite—that is, coal treated by the process mentioned—will have to bear almost the whole cost of its manufacture. How dear it would be under such circumstances, we may easily imagine."

The Dearth of Pennies.

Under the heading of "The Eternal Lack of Pence," our contemporary the "Ironmonger" last Saturday made the following remarks: "It is interesting to notice what a great strain on the bronze coinage, especially the pennies, of the country is being put by the increasing number of automatic machines that are in use. Coin-freed gas-meters are, of course, not the only offenders in this respect, as there are the weighing and sweatmeat machines found on railway platforms, besides other apparatus of problematical utility. But the enormous numbers of prepayment gas-meters must render them very absorptive. The temporary removal of coppers from circulation has reached such a pitch that the Deputy-Master of the Mint has recently estimated that upwards of 60 million pennies, equal in value to £250,000, are continually locked up in the machines—an amount, he says, which exceeds the total issue of pence for the three years 1903-5. We have recently had an opportunity of noticing the dearth of coppers in a provincial town, where, we believe, the slot gas-meters are only cleared once a month. In the ordinary way, there is the usual suburban Monday morning difficulty in getting change for gold, while pence can hardly be procured for love or silver at any time. One cannot help suggesting that, as there is a profit made by the Mint—*i.e.*, the Government—on the coinage of bronze and silver, this institution might rise to the occasion, and give us a little more."

Scheme for Acquiring the Douglas (I.M.) Gas-Works.

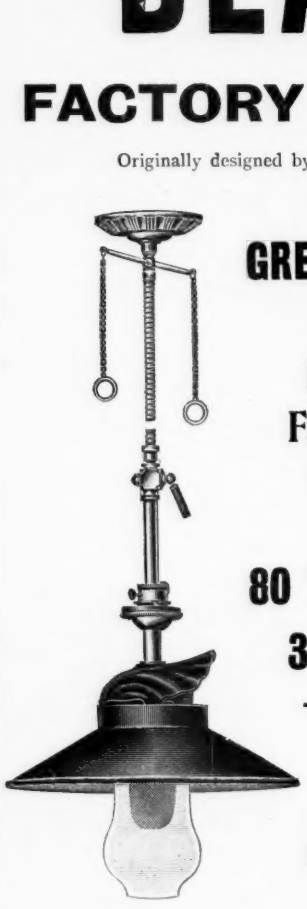
The "Isle of Man Daily Times" for the 27th ult. contained a long letter by an anonymous correspondent setting forth a plan by which the Douglas Corporation could acquire the undertaking of the Gas Company and carry it on in the interests of the town without raising any money for the purpose. He proposes to ascertain the value of the Company's property by taking the prices realized for their shares during the last three years, striking an average, and adding 10 per cent. for compulsory purchase. Taking £70 as the average price per share, the total capital is £200,000; and he would arrange that the town should stand indebted to the shareholders for this sum *plus* the 10 per cent. He would pay the £200,000 in negotiable bonds of small amounts (£1 or £5), secured primarily on the gas undertaking, and secondarily on the rates. He proposes that half the profits should be devoted to cancelling the bonds, and the remainder to reducing the price of gas. He contends that by the adoption of his scheme Douglas would become possessed of the gas undertaking on the basis of a three years' average of the market price of the shares, and all the future additional profits arising from the expansion of the town would go to the advantage of the ratepayers. With regard to the possibility of gas lighting being supplanted by electricity, he thinks this contingency might arise, but not to an alarming extent. He considers that, with the enormous improvements made in the illuminating power of gas and in the economy of its manufacture and consumption, "many a day will elapse before gas will be abolished by the more modern illuminant." Moreover, he points out that it must not be forgotten that for cooking and heating purposes, and for the development of power, there must always be a vast field for the consumption of gas.

Visit to the Southport Gas-Works.—In response to an invitation by the Gas Committee, the members and officials of the Southport Corporation last Tuesday visited the gas-works at Crowlands; the guides being the Chairman of the Committee (Alderman Travis) and the Engineer (Mr. John Bond). After the inspection, the party sat down to tea, when Alderman Travis, who presided, gave some interesting particulars regarding the undertaking. He said they were at the present time getting something like 11,000 cubic feet of gas, or rather over, per ton of ordinary Wigan slack; and the lighting power, according to the "Metropolitan" burner approved by the Board of Trade, was 17 candles. During the last three years, including the current year, they had paid for the relief of the rates £39,000. During the previous three years, the amount was about £31,000; and for the three years prior to that £24,000. Mr. Bond and his staff had co-operated heartily in bringing about the excellent results which had been obtained.

THE BLAND

FACTORY LIGHT

Originally designed by Bland & Co.



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Gas Regulating Nipple with Triangular Needle and Side Adjustment.

Anti-Back Lighter.

Steatite Nozzle.

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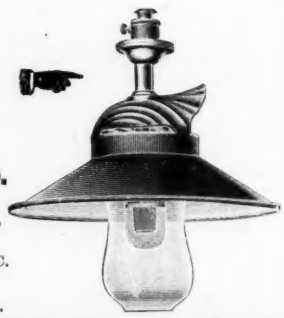
Please note the exact shape of the original Bland Factory Light.



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New Catalogues.

Messrs. Bland and Co. have sent us their catalogue for 1907-8. It contains illustrations of their inverted burner, manufactured in various styles to suit every purpose. The particulars and prices of the burners, lamps, and fittings shown are preceded by some useful observations on the advantages of gas lighting by the inverted system, and its great economy as compared with flat-flame lighting and electricity.

We have received from Messrs. J. & W. B. Smith their general catalogue for 1907-8. It consists of nearly 200 large quarto pages illustrating a great variety of gas "arc" lamps, pendants, brackets, globes and shades, burners, mantles, and accessories for upright and inverted incandescent gas lighting. A special feature is the "Nulite" lamp, which is specially suited for lighting shops, show-rooms, &c.

The new price list for 1907-8 of the Welsbach Incandescent Gas-Light Company, Limited, whose head offices and show-rooms at Welsbach House are conspicuous features of the King's Cross end of the Gray's Inn Road, is a catalogue nearly equal in proportions to the one just noticed. The Company are the sole manufacturers and owners in the United Kingdom of the system from which they derive their name, as well as of the Welsbach-Kern patent lighting, heating, and cooking systems. The Company's goods—mantles, burners, globes, fittings, &c.—are shown in endless variety in their new list.

The Popularity of the "Penny-in-the-Slot" Meter in the North.—According to the "Glasgow News," the penny-in-the-slot meter, as the returns of the Glasgow Gas Department show, is growing rapidly in favour, but with no section of gas users so much as with landladies. These thrifty and ingenious women have discovered in the pay-as-you-go meter a slight protection against the lodger who stays out late, and, on getting home, sits up in his room for two or three hours, or, what is even worse, goes to bed with a book, and ultimately falls to sleep with the gas "bleezing." Now the Scotch landladies can measure their young men to a foot (cubic) and feed the meter accordingly; consequently any further supply of the necessary light must come off the young man's side of the ledger.

The New Water-Works for Bolton.—The question of whether the additional water-works for Bolton, which were stated to involve the expenditure of about £250,000, should be constructed under contract or by the Corporation administratively was discussed at the monthly meeting of the Town Council on Wednesday. The Water Committee recommended the acceptance of the tender of Messrs. Best and Sons, of Edinburgh, for the reservoir; but Mr. Jones (one of the Labour members) moved as an amendment that the contract should not be accepted, and that the work should be done administratively—a method which he said the working-men ratepayers of Bolton favoured. Mr. Cooper, the Chairman of the Committee, said they wanted a good reservoir, and therefore they handed over the making of it to men who had a good reputation for this class of work. After other members had spoken, a division resulted in the defeat of the amendment by 56 votes to 10; and the Committee's proceedings were confirmed.

Complaints of Pollution at Carlisle.—Complaints by the Fishery Board of pollution of the Caldew have been under consideration by the Carlisle Gas Committee. The Engineer (Mr. W. J. Smith) was instructed to submit proposals for preventing the percolation of any oil or any other substance into the river; and he recommended that the carburetted water-gas relief holder should be steel-lined at a cost of £1100, that one of the other holders should be coupled to the carburetted water-gas plant at a cost of about £50, and that a cyclone tar extractor should be installed at a cost of £75. In order to maintain the supply of gas while the lining of the holder was being carried out, it would be necessary to lay a main (at an estimated cost of about £800) connecting the holder at Boustead's Grassing with the gas-works; but this would in any case require to be done in the near future. It was agreed to adopt these recommendations, and to instruct the Engineer to obtain tenders for carrying out the work. Application will be made to the Local Government Board for sanction to borrow the £800 required for laying the main.

County Water Scheme for Monmouthshire.—The principal subject of discussion at the meeting of the Parliamentary Committee of the Monmouthshire County Council at Newport last Wednesday was the proposed County Water Bill. The report of Mr. Baldwin Latham, M.Inst.C.E., provided for the construction of three large reservoirs on the Grwyne River, on the borders of Breconshire and Monmouthshire, at a total cost, to supply 4 million gallons per day, of £730,000. At the meeting on Wednesday, he submitted a further report to the effect that the site of the drainage area and the sites of the reservoirs could be acquired on very reasonable terms. He strongly recommended the members of the County Council to make arrangements to view the place, and said they would be satisfied of the enormous advantages offered by the construction of works in such a locality. There was a good deal of discussion; and in the result it was resolved by a practically unanimous vote to recommend the Council to promote a Bill next session, to contain protective clauses for the Ebbw Vale, Nantyglo and Blaina, and Tredegar districts, where water-works have been provided.

Price of Gas for Street Lighting at Middleton.—A proposal by the Gas Committee that they should increase by 3d. per 1000 cubic feet the price charged to the Watch Committee for the gas supplied for street lighting purposes, was sent back to them for further consideration by the Town Council. The price at present paid by the Watch Committee is 2s. 6d. per 1000 cubic feet; and it was stated that the extra cost if this were raised to 2s. 9d. would be rather over ½d. in the pound on the rates, while it would add £150 or £200 a year to the receipts of the Gas Committee. It was pointed out that coal had gone up 2s. per ton, and it was costing the Committee something like 1s. 2d. per 1000 cubic feet to produce gas. Some of the members of the Gas Committee were also members of the Watch Committee, and agreed that what was being done was only fair and right, so that the resolution being sent back again to the Committee would not have the slightest effect. One argument against the proposed increase was that it would have an adverse effect on the lighting of the town, by causing the Watch Committee to economize in the matter of gas consumption.

GODIN'S STOVES

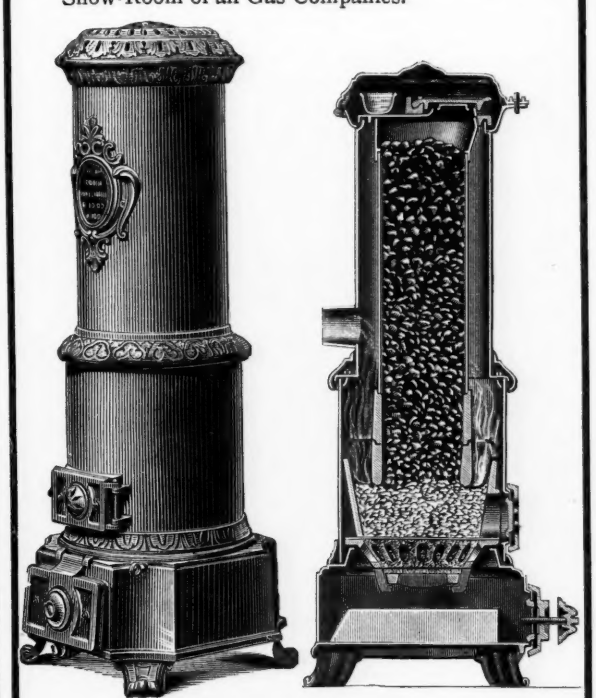
4000 Patterns.

BURNING COKE

Annual Output 200,000 Stoves.

A Consulting Engineer writes:—

"GODIN'S COKE STOVES deserve the attention of Gas Companies, especially during the present high price of household coal, and good COKE STOVES ought to be in the Show-Room of all Gas Companies."



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Telephone Nos.: 1890 HOLBORN; CENTRAL 194.

A. G. CLOAKE,

54, HOLBORN VIADUCT, LONDON, E.C.

Lighting of Moretonhampstead.—Arrangements have been made with the Devon Gas Association for the lighting of Moretonhampstead by means of incandescent burners (33 lamps) for a term of three years for the sum of £100 per annum; the Association also undertaking to erect, maintain, and light in the same way any additional lamps that might be required by the Council for the sum of £3 2s. 6d. per lamp per annum.

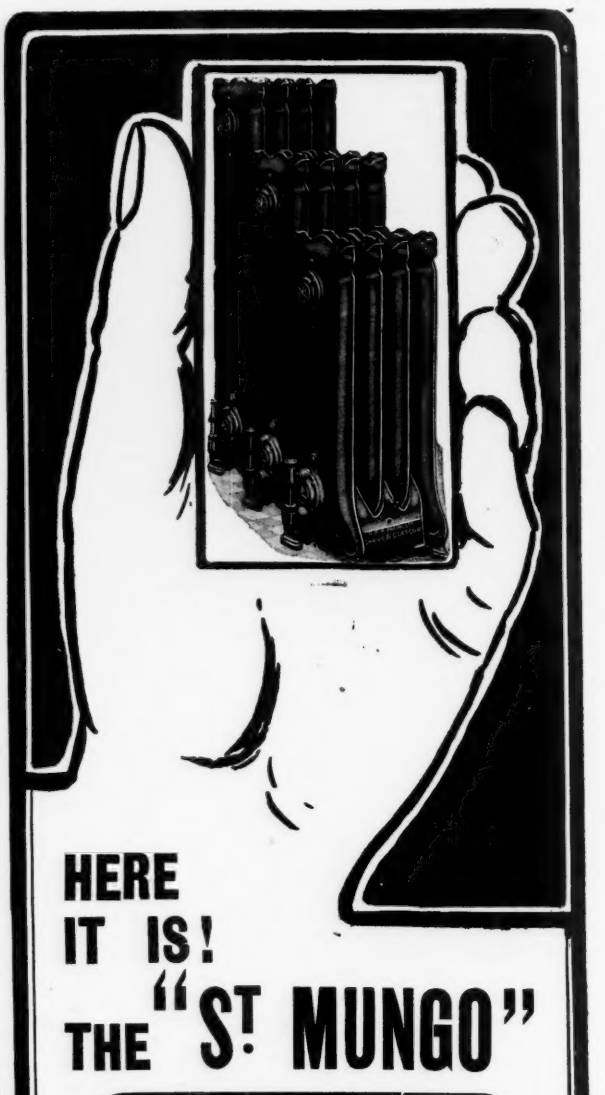
Gas-Workers' Wages at Oldham.—The General Manager (Mr. Arthur Andrew) reported at the last meeting of the Oldham Gas Committee that some correspondence had taken place between himself and Mr. J. R. Clynes, M.P., of the Gas-Workers' and General Labourers' Union, with regard to an application by the employees (including a section of the retort men) for an increase of wages. He had informed Mr. Clynes of the decision of the Committee that (after consideration of the wages and conditions in fifty other towns) they could not see their way to grant the advance; and Mr. Clynes had expressed his regret that such a decision should have been come to without any opportunity being given of discussing the matter with the Committee. Subsequently the retort men and meter inspectors held a meeting under the presidency of Mr. Clynes to consider the refusal of the Committee to grant the advance asked for; and it was decided that a ballot should be taken as to whether steps should be adopted to press the claim.

Deaths from Gas Poisoning.—An inquest was held at Hackney last Saturday week regarding the death of Mr. George Lampard, a retired tea merchant. Deceased, who was 70 years old, was defeated at the last London County Council election; and his widow stated that he became depressed as he had nothing to do. On the preceding Thursday, he was found on the hearthrug in his bedroom with his head near a gas-ring the tap of which was turned full on. Both windows were open, but the door was locked. The doctor stated that deceased had a cut on the knee, suggesting that he had had a fall, and there was a burnt match on the floor. The Jury returned a verdict of "Accidental death;" and in reply to the Coroner the Foreman said they thought deceased inadvertently turned the gas on, when he had a fall. The Coroner, however, intimated that he did not agree with the verdict. Last Friday, Mr. George Tunnicliffe, a Birmingham hardware merchant, was found dead in his bath. The gas was turned full on, but not lighted.

Monte Video Water-Works Company.—An extraordinary general meeting of this Company was held last Tuesday, to consider a proposal to increase the capital to £750,000, by the creation of £12,500 new shares of £20 each. The Chairman (Mr. J. Anderson), in moving the necessary resolution, said the rapid development which had taken place in the Company's business in 1905 and 1906 had been continued in even greater ratio during the present year. Additional works were required; and when they were completed the Company would be capable of supplying all the water the city was likely to want for many years. The cost of the extensions was estimated at about £200,000; and the Board proposed to raise the money by the issue of a like amount of ordinary shares, to be offered to the shareholders *pro ratâ* at par. This would be equal to an allotment of 40 per cent. on existing holdings, or four new shares for every ten now held. The Directors calculated that the Company's earnings, even on the present reduced tariff, would enable them to pay a dividend of 7 per cent. on the new shares when fully paid up, as well as on the old shares, and leave a good margin. Mr. F. S. Isaac seconded the motion, and it was carried.

Devonport Water-Works Improvements.—It was decided by the Devonport Corporation Water Committee last week to proceed at once with the construction of the first part of the works authorized by the Act obtained by the Corporation last session. With a view to prevent the risk of pollution, as well as to conserve the supply, pipes are to be laid from Dousland to Roborough—a district in which, owing to its proximity to an increasing number of dwellings, the present open leat is an undesirable means of conveying water. The five miles of pipes for this section are to be bought, and the laying of them is to be carried out by direct labour under the supervision of the Water Engineer (Mr. F. W. Lillicrap). It was also decided to proceed with the construction of the service reservoir at Dousland, the cost of which is estimated at £23,515. These measures when carried out will, it is hoped, obviate to a considerable degree the risk of a stoppage of the supply by snow and frost, such as was experienced during the severe weather of last winter. The substitution of pipes for the present open channel is expected to have the effect of saving 600,000 gallons of water which is now estimated to be lost daily through evaporation and leakage. Beyond Dousland in the direction of Dartmoor, whence the supply is derived, there are 17 miles of open leat; but as this is not subject to the same risk of contamination as the length nearer the town, it is not intended to deal with it at present.

Voteless City Companies.—Before the members of the United Wards Club last Wednesday evening, Mr. Carl Hentschel read a paper on "Voteless Companies, or Taxation without Representation." In April, 1906, he said, the number of undertakings existing under the Joint-Stock Companies Acts was 40,995, with a paid-up capital of £2,003,392,000. This was, of course, irrespective of companies working under Acts of Parliament, such as railway, gas, and water concerns, &c., and those incorporated by Royal Charter. Not one of these companies had a voice in the expenditure of the public funds, towards which all were forced to contribute. The position in the City was so exceptional as to justifiy a claim for special legislation. In 1903, the amount of rates raised from companies having no voting power was 46 per cent. of the total; of the whole of the electors on the register, about 63 per cent. were persons who were not called upon to meet the demands of the rate collector. It was computed that, of the City's total rateable value of £5,300,000, the property upon which limited liability companies were rated was £2,000,000. None of these companies had a vote. He was hopeful that an advance in the direction of remedying the evil would result from the course taken by the Court of Common Council in January last, when it was referred to the County Purposes Committee for them to consider and report what steps it was desirable to take for the due representation upon the register of voters of limited liability companies.



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Increases in the Price of Gas.—The Camborne Gas Company have increased the price of gas from 4s. 9d. to 5s. per 1000 cubic feet, subject to a discount of 5 per cent. for consumers of 30,000 feet per quarter and 2½ per cent. for smaller consumers. At Totnes, the price of gas has been increased to 4s. per 1000 feet; and at Crediton there is an advance of 2d. per 1000 feet.

Strike of Italian Gas Workers.—A short time ago the Italian workmen employed by L'Union des Gaz at Milan, Genoa, Alessandria, and Messina presented a memorial for an increase of wages, which would involve, it was stated, an additional payment of about £40,000 for labour. Instructions were sent to the Manager at Milan (Signor Lacombe) to negotiate with the men; but his efforts have only been partially successful, as we learnt yesterday that those employed at Milan, Genoa, and Alessandria had struck work. By this act they will, we understand, lose certain benefits obtained by them under an agreement made in 1901.

New Reservoir at Ipplepen.—The completion of the new works for the water supply of Ipplepen was marked by festivities last week. The village is one of the places on the line of the main by which Paignton obtains its new water supply from Dartmoor; and an arrangement has been entered into by which it is to have for the next thirty years from a minimum of 16,000 gallons to a maximum of 30,000 gallons per day, at the price of 8d. per 1000 gallons. A reservoir has been constructed with a capacity of 75,000 gallons, and other necessary works carried out, at a cost of about £3000. The water was turned on by Mr. M. Fortescue, who expressed the opinion that the supply would be of great advantage to the village, and would promote its prosperity.

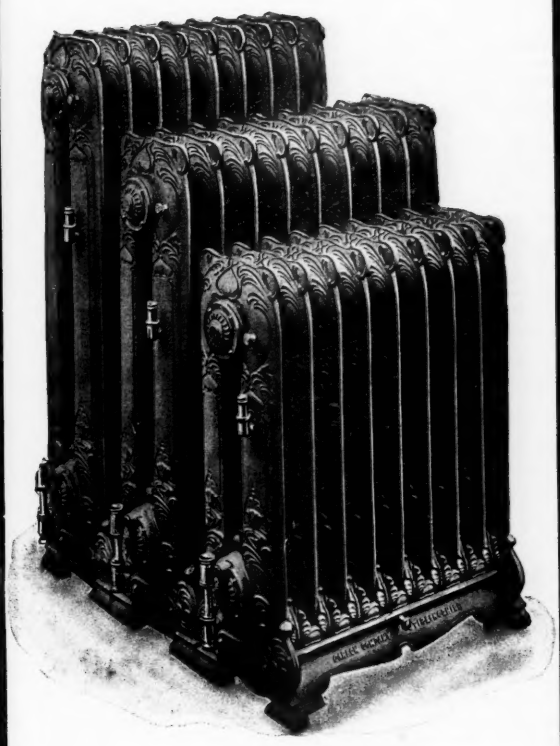
Incandescent Burners for Church Lighting.—The lessees of the Stowmarket Gas-Works have just completed a very successful installation of the "K" inverted burners of Moffat's Limited at the Stowmarket Parish Church. The existing gas-brackets, standards, and pendants have been utilized for the purpose in such a way that 32 "K" burners are now taking the place of 191 ordinary flat flame burners which provided the old illumination. It is interesting to note that though, in aggregate illuminating capacity, the new installation is nominally inferior to the one supplanted—2560-candle power against 3056-candle power—in the opinion of everybody concerned the 32 "K" burners furnish an infinitely better light than did their predecessors. The change in the lighting has, we are informed, given the greatest satisfaction to the Vicar and the Churchwardens.

Swansea Gas Company.—Presiding at the half-yearly meeting of the Swansea Gas Company, Mr. T. Travers Wood said the system of drainage in the district was very unsatisfactory, and had caused the Company to make some very important alterations in their plant, closing up the large culvert into the Oystermouth Road, through which they formerly supplied the town with gas. But even after doing so, the sewage found its way to Oystermouth Road, and continued to injure the property of the Company. The usual dividends at the rate of 5 per cent. were declared. The shareholders approved of the decision of the Directors not to hold in future a half-yearly ordinary meeting; but that interim dividends should be paid and posted to the shareholders in October of each year. Gratification with the very satisfactory balance-sheet for the half year was expressed; and thanks were tendered to the Directors and the staff.

Cirencester Gas Company, Limited.—At the annual general meeting of the Company on the 28th ult., the Directors reported that there had been a record increase in the sale of gas in the twelve months ending the 30th of June—amounting to 2,220,300 cubic feet. The revenue was £10,828, and the expenditure £7921; leaving a balance of £2901. This sum, after allowing for interest on debentures and the interim dividend, was sufficient for paying dividends for the half year at the rate of £12, £8 8s., and £6 per cent. on the several classes of shares, and also for placing a further sum of £250 to the depreciation account and writing off £200, the balance of the outlay on the sulphate of ammonia plant; leaving £212 to be carried forward. The Directors recommended the disposal of the profit in the way stated, and it was agreed to. They also reported that the prepayment meters now numbered 700, most of which had cooking-stoves attached; and there were 240 stoves on hire.

Pembroke Docks and Town Gas Company.—The annual meeting of this Company was held at Newport (Mon.) on the 27th ult.—Mr. G. E. Wheatly Cobb in the chair. The Directors' report and statement of accounts were approved. The profit on the year's working amounted to £2684, which with £654 brought forward made a total of £3338, out of which interim dividends at the rate of 8 per cent. on the original and £5 12s. per cent. on the new shares, debenture interest, and bank charges, amounting in all to £1261, had been paid; leaving £2078 available for distribution. It was recommended that dividends after the same rate should be paid for the second half of the financial year, £400 carried to the renewal account, and the balance (£984) carried forward. It was stated that the continued rise in the price of coal had caused the Directors some anxiety; and after renewing their contracts for the ensuing year, they found it necessary to increase the price of gas 2d. per 1000 cubic feet. The sale of gas had been slightly less—about 1 per cent.—than in the previous year, on account of the discharges from the dockyard; but as these appeared to have ceased, there was reason to hope that this downward tendency would be arrested. With regard to the proposed transfer of the small portion of the Company's district situated in Neyland to the Urban District Council, arbitration proceedings had taken place, an award had been made, and the Directors now hoped to bring the matter to an early conclusion.

We learn from the Secretary of the Robertsbridge, Salehurst, and Hurst Green Water and Gas Company, Limited (Mr. John Harris), that the gas-works at Robertsbridge will be opened within the next fortnight. The Company are placing the contract for meters, stoves, and complete slot installations with Messrs. R. & A. Main, Limited, who will hold an exhibition at Robertsbridge on the opening of the works. This firm (not Messrs. Thomas Glover and Co.) were responsible for the similar arrangements at Amman Valley and Whitland, as noticed last week.



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STRONG IN CONSTRUCTION.

ARTISTIC IN APPEARANCE.

The most efficient method of Heating by Gas.

Full Particulars on application to

Carron Company

INCORPORATED BY ROYAL CHARTER 1773

Works:

CARRON, STIRLINGSHIRE.

We have received a copy of a new monthly illustrated publication bearing the title of "Holophane." It is issued by the Sales and Engineering Departments of the Holophane Company of New York, and sets forth some of the special advantages of the Company's system of illumination.

At the meeting of the Shanklin Urban District Council last Tuesday, it was reported that the Local Government Board had sanctioned the preliminary works at Chillerton being proceeded with, in connection with the proposed auxiliary water supply. It was decided to apply to the Public Works Loan Commissioners for an advance of £650, the amount necessary for carrying out the works.

As bearing upon the subject of the future of the cement industry, to which reference was made in the "JOURNAL" last week, we learn that Mr. W. Antrobus, a Chemical Engineer of Manchester, has just patented an improved system of producing portland cement, whereby all the bye-products contained in the coal and other raw materials, which have hitherto been utterly wasted, though of many times the value of the cement, are retained and utilized. It is claimed that by this system a first-class cement can be produced in the Manchester district at 5s. per ton, by using up coal-pit bank waste, which is admirably suited for the purpose. Among the advantages claimed for this system is that it renders possible the production of ordinary gas at 6d., and producer gas at 1d., per 1000 cubic feet.

In a discussion upon the tarring of roads, it was shown to be the opinion of the members of the Cuckfield Urban District Council that the tarring done by hand was cheaper and more effectual than that done in the district by machine. One member suggested that it would be a good thing if the County Council would contribute in the same proportion to tarring by hand as they did to machine tarring.

The Davis Gas-Stove Company, Limited, held a travellers' conference at their new works (the Diamond Foundry) at Luton on the 27th ult.; and we learn that a considerable impression was created on all present, both by the great strides which had been made in getting the works into going order since the previous visit, and by the very up-to-date character of the gas heating-stoves introduced for the 1907-8 season, and other specialities in the course of preparation for next year's trade.

Mobberley and Perry, Limited, was registered last Tuesday, with a capital of £75,000, in £10 shares, to adopt an agreement with J. Mobberley, H. Perry, Phœbe L. Perry, G. H. P. Perry, and J. E. Perry, to amalgamate (1) the business of fire-brick manufacturers, &c., carried on at the Hayes Works, Oldswinford, the Hurst Works, Woodside, Dudley, the Fire-Brick Works at Himley and Merry Hill, and the Thorns, Kingswinford, as Mobberley and Perry, and (2) the undertaking of the Oldhall Colliery Company, of Cradley. There will be no initial public issue.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

ENGINEER AND MANAGER (WATER-WORKS). T. T., c/o Vickers, Nicholas Lane, E.C.
MAINLAYERS. Wisbech Water Company.

Situations Wanted.

ACCOUNTANT, CLERK OF WORKS, OR MANAGER. No. 4844.
GENERAL CLERK. No. 4840.
TRAVELLER. No. 4846.

Gas-Works for Sale.

KENT COUNTY GASLIGHT AND COKE COMPANY. By Auction, Oct. 25.

Gas Literature Wanted.

L. P. LOWE, 1214, Polk Street, San Francisco.

Stocks and Shares.

SOUTHEND GAS COMPANY. Oct. 29.
YARMOUTH WATER COMPANY. Oct. 29.

TENDERS FOR

Coke.

SHEPPY GAS COMPANY. Tenders by Oct. 16.

Governor, &c.

WOLSTANTON DISTRICT COUNCIL. Tenders by Oct. 28.

Meter (Station).

WOLSTANTON DISTRICT COUNCIL. Tenders by Oct. 28.

Pipes, &c.

STOCKPORT GAS DEPARTMENT. Tenders by Oct. 23.

Sulphate Plant.

WOLSTANTON DISTRICT COUNCIL. Tenders by Oct. 28.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 83.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20½–21½	+½	4 17 8
268,324	10	,,	7½	Do. 7 p.c.	13½–14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½–7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4½–5½	..	5 6 8
50,000	10	Aug. 29	14	Bournemouth Gas and Water 10 p.c.	27½–28½	..	4 18 3
51,810	10	,,	7	Bournemouth Gas and Water B 7 p.c.	16½–17	..	4 2 4
53,200	10	,,	6	Bournemouth Gas and Water Pref. 6 p.c.	14½–15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	247–252	..	4 19 2
300,000	,,	,,	9½	Do. New	185–190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	115–120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb.	100–103	..	3 17 8
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	215–220*	..	5 2 3
246,320	,,	,,	8½	Do. A. Ord. Stk.	155–160*	..	5 3 2
460,000	20	,,	10	British	40½–41½*	..	4 16 5
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116–119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	87–90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	11–11½	..	6 1 9
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	26½–27½	..	6 0 0
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11–13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8–9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50–52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94–96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	106½–108½	..	4 12 2
1,443,280	Stk.	,, 29	5⅛	Commercial 4 p.c Stk.	101–106	..	4 18 1
560,009	,,	,,	5	Do. 3½ p.c. do.	98–103	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112–117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–143	..	4 17 11
460,170	Stk.	—	5½	Derby Con. Stk.	123–125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	22½–23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½–18½	..	*4 17 4
15,182,590	Stk.	Aug. 15	4⅛	Gaslight 4 p.c. Ord.	94–96	+1	4 11 7
2,600,000	,,	,,	3⅜	Gaslight 3½ p.c. max.	86–88	..	3 19 7
3,799,735	,,	,,	4	and Coke 4 p.c. Con. Pref.	104–107	..	3 14 9
4,193,975	,,	June 13	3	and Coke 3 p.c. Con. Deb.	81–83	..	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93–98	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114–117	..	5 11 1
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	13–20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	175–177	+1	4 10 5
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91–93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	110–120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108–110	..	3 12 9

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A.	221–223	..	4 9 8
718,100	,,	,,	7	Do. B.	160½–161½	..	4 6 8
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	142–147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4–4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	100–102*	+1½	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102*	+1½	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½–11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	107–108	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90–91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19–20	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12⅛–13⅛	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140–145	..	5 10 4
60,000	5	Sept. 13	7	Ottoman, Ltd.	5⅞–6⅛	..	5 12 0
398,490	5	May 15	7	Primitiva Ord.	6¼–7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	5–5¼	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	13¼–13⅜	..	5 16 5
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
250,000	10	Sept. 27	8	San Paulo, Ltd.	12⅞–13⅛*	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48–50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	242–244	..	4 2 0
209,984	,,	,,	10	Do. B	242–244	..	4 2 0
523,500	,,	,,	10	Do. C	242–244	..	4 2 0
70,000	10	June 13	10	South African	15–16	..	6 5 0
6,429,895	Stk.	Aug. 15	5⅛	South Met., 4 p.c. Ord.	119–121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81–83	..	3 12 3
201,720	Stk.	Sept. 13	8	South Shields Con. Stk.	155–157	..	5 1 11
605,000	Stk.	Aug. 15	5⅛	S'th Suburb'n Ord. 5 p.c.	114–117	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	117–120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120–125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105–110	..	4 10 11
120,000	Stk.	Aug. 15	6⅝	Tottenham A 5 p.c.	120–123	..	5 9 9
398,940	,,	,,	5¼	and B 3½ p.c.	100–103	..	5 1 11
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	99–101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10½–10¾	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100–102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107–109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6½	and B 3½ p.c.	128–133	..	4 17 9
75,000	,,	,,	5⅜	and C 3½ p.c.	—	..	—
80,075	,,	June 27	3	Putney 3 p.c. Deb. Stk.	77–80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	101–104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118–120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100–103	..	3 17 8

Prices marked * are "Ex div."